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# NUEXCO

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DECEMBER 1980

NUMBER 148

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## Monthly Report on the Uranium Market

# NUEXCO

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## EXECUTIVE SUMMARY & INDUSTRY OVERVIEW NUEXCO REPORT 148

The **Exchange Value** remained unchanged this month at \$28.00 per pound U<sub>3</sub>O<sub>8</sub>. There was little evidence last month of price cutting by sellers to effect sales. However material available for sale for spot or near term delivery now amounts to 8.4 million pounds U<sub>3</sub>O<sub>8</sub> (2.1 million from producers, the balance from inventory holders), whereas there is very little spot and near term demand. This imbalance might be expected to put downward pressure on prices this month especially since some of the active sellers in the market may wish to include sales in fiscal 1980 results.

The **Transaction Value** declined slightly to \$28.70 per pound U<sub>3</sub>O<sub>8</sub> from \$29.00 last month. Three sales transactions closed last month, all at fixed prices for 1981 delivery. All three sales were for amounts between 100,000 and 300,000 pounds U<sub>3</sub>O<sub>8</sub>. It is apparent that sellers are willing to fix prices for delivery and payment many months in the future. The transactions which closed this month involved some deliveries to mid to late 1981 at fixed prices at or near this month's Exchange Value.

The election of Ronald Reagan as President has sparked a new sense of optimism in the **US** nuclear industry. However the new Administration is not expected to have any near term influence on the uranium industry. The issue of nuclear power and the new political environment is discussed in detail in the *Commentary* section of this month's Nuexco Report.

In **Canada**, a licensing decision by the Key Lake Board of Inquiry is expected soon. Key Lake is one of the world's largest and richest uranium deposits. If licensing of the facility is approved, the owners' plans now call for annual production in the eight to ten million pound range, which would make Key Lake one of the world's largest production centers.

The **Australian** government announced last month that it would permit reprocessing of Australian source uranium in connection with power production under certain conditions, including the requirement that the recovered plutonium be safeguarded against nuclear proliferation. This new policy on reprocessing is based upon the conclusions of the INFCE study, and is expected to improve the prospects of additional sales of Australian uranium, especially to **France**.

This month's *Raw Materials* section contains a description of the Schwartzwalder mine in the Front Range of Colorado.

*This Executive Summary may be reproduced for internal distribution.*

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# NUEXCO

## MONTHLY REPORT ON THE URANIUM MARKET

December 1980

No. 148

JAMES E. VAUGHAN, *EDITOR*

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# NUEXCO

## *FOREWORD*

Nuexco President Bob Wolcott made an address to the Alternative Energy Sources Committee of the New Mexico Legislature. A copy of his remarks is included as an insert to this Report.

We made a systematic error in the data production for Table 6 of Report 147 (November 1980). A corrected copy of Table 6 is included as an insert to this Report.

## URANIUM MARKET

## AUSTRALIA

As noted last month, Prime Minister Fraser's Liberal-National country coalition now commands a comfortable 23-seat margin in the Australian House of Representatives. But the final results of the 64-seat Australian Senate elections show the Liberal-National Country coalition won only 31 seats rather than the 32 indicated earlier. The seat which was lost went to the Democrats. The Democrats hold five seats, one seat is held by an independent and the final 27 by Labor. While lacking a majority, the government coalition, together with support from Tasmanian Senator Harradine, the independent, can block any legislation proposed jointly by Labor and the Democrats, and thus, no practical problems are foreseen for either the Fraser Government or its pro-uranium policies.

Deputy Prime Minister Anthony recently commented that "a large proportion of the production from ... existing approved uranium projects (Mary Kathleen, Ranger, Nabarlek and Yeelirrie) is already committed." Indicating that he felt such commitments reflected confidence in Australia, its reliability and capacity to supply, Anthony went on to say that "the position has now been reached where additional uranium projects should proceed so the momentum of Australia's advance into the world market can be maintained."

Based on recent demand forecasts, Mr. Anthony's comments appear to be very optimistic. Despite the desires of a number of Australian organizations to move into production as soon as possible, the ability to obtain sales commitments will, in the last analysis, determine when new projects will get under way. The changing market situation is nowhere better reflected than in the sharply lower prices that Japanese buyers have proposed for 1981 deliveries from Australian producers. Whereas 1980 prices were in the mid-\$10 per pound U<sub>3</sub>O<sub>8</sub> range, it can be expected that 1981 prices, when finally settled, could be in the mid-\$30 range.

In Nuexco Report No. 146, Japanese participation in the Ranger project through Japan-Australia Uranium Resource Development Company, Ltd. (JAURD) was described in some detail. Ninety percent of JAURD is owned by three utilities, Kansai, Kyushu and Shikoku, and, contrary to previous reports, JAURD's staff and management is provided primarily by these utilities, not C. Itoh.

The Australian Minister for Foreign Affairs announced last month that the Government has decided to permit reprocessing of Australian origin uranium under certain conditions. The conditions outlined by the Minister for approval of reprocessing include:

1. Reprocessing will be allowed in association with power production.
2. Storage and use of the plutonium would be in a manner that causes no danger of nuclear proliferation.
3. Agreement by the end user of continued consultation and review of the conditions for reprocessing.
4. End user commitment to support development of more effective international control measures.

This decision by Australia is expected to substantially improve prospects for additional uranium sales, especially to France.

## CANADA

The energy policy in Canada remains uncertain. It is complicated by uncertainties surrounding the debate on the new Canadian Constitution. The Constitution has been viewed by the provinces as a threat to their control of the use and sale of natural resources occurring within provincial boundaries, a power now vested with the provinces under the British North America Act, which serves as the current Canadian Constitution.

Part of the controversy surrounding the Constitution revolves around the shift of Canadian "money capitals" westward. This shift is due mainly to the strength gained by the western provinces through oil, gas and other resources. Thus it is partly an *east vs. west* problem.

The east vs. west controversy is very apparent in the uranium industry, with new production coming on line in Saskatchewan. Development of the new production centers will be regulated by the province, but export conditions will be regulated by the Federal government.

Development of the Key Lake deposit in northern Saskatchewan is currently awaiting approval of the Environmental Impact Statement by the Key Lake Board of Inquiry. A decision is expected shortly. Key Lake, jointly held by Saskatchewan Mining Development Corporation (SMDC), Uranerz Canada, and Eldor Resources, is one of the largest and richest uranium deposits in the world. Announced reserves are about 70,000 metric tons U<sub>3</sub>O<sub>8</sub> at an average grade of 2.5 percent U<sub>3</sub>O<sub>8</sub>. The production center planned

## URANIUM MARKET

by the joint owners is larger than had previously been assumed, in the region of eight to ten million pounds U<sub>3</sub>O<sub>8</sub> annually. While the ability to market the output will probably determine the ultimate size of the facility, it would appear that the magnitude and grade of the deposit would lead to economies of scale and operating economies that should enable Key Lake to compete favorably for market share.

### EUROPE

Pro-nuclear groups in Austria were successful in obtaining enough voter signatures to require the Austrian Parliament to consider whether to have another national nuclear referendum. If the Parliament approves by a two-thirds majority vote, then a new referendum will be placed on the ballot concerning the law which now prohibits operation of the Zwentendorf nuclear power plant. The decision by Parliament is not expected before February 1981.

### FAR EAST

Korea Electric Company announced this month that it has signed contracts with Framatome and Cogema of France for nuclear equipment and fuel for Korea's eighth and ninth nuclear plants. The plants will be 950 MWe units, and are scheduled for startup in 1987 and 1988. The fuel contract with Cogema involves a ten year supply of enriched uranium for both units.

### UNITED STATES

The election of Ronald Reagan as President has prompted a sense of optimism throughout the US nuclear industry. Mr. Reagan's pronuclear attitudes, combined with the Republican controlled Senate, are expected to eventually lay a new political foundation for the nuclear industry. The issue of the possible effect of the new Administration on the nuclear industry is discussed in detail in the *Commentary* section of this Report.

The Alternative Energy Sources Committee of the New Mexico Legislature is holding hearings on the New Mexico severance tax on uranium. The severance tax was enacted in 1977 and increased in 1980. New Mexico's share of US uranium production has decreased from 48 percent in 1976 to 40 percent in 1979, and is expected to decline again in 1980. One

contributing cause of the decline might be the fact that New Mexico's severance tax is by far the highest in the nation. Table 1 compares severance taxes in four major uranium producing states. The high tax rate in New Mexico is further magnified by the fact that it is applied to the value of uranium concentrates rather than at the mine mouth on the value of unprocessed ore.

Table 1  
URANIUM SEVERANCE TAXES IN  
FOUR URANIUM PRODUCING STATES<sup>1</sup>

| State                   | Severance Tax at<br>\$30 lb U <sub>3</sub> O <sub>8</sub> Sales Price<br>(\$ lb U <sub>3</sub> O <sub>8</sub> ) |
|-------------------------|-----------------------------------------------------------------------------------------------------------------|
| New Mexico <sup>2</sup> | 2.375                                                                                                           |
| Wyoming <sup>3</sup>    | 0.30-0.45                                                                                                       |
| Utah <sup>4</sup>       | 0.20-0.30                                                                                                       |
| Texas                   | none                                                                                                            |

<sup>1</sup>Source: Lynn Jacobsen "New Mexico Uranium Severance Taxes," October, 1980.

<sup>2</sup>A temporary credit of 50 percent of the tax due on the first 100,000 pounds is available in FY 1980-81; on 75,000 pounds in FY 1981-82; and on 50,000 pounds in FY 1982-83.

<sup>3</sup>Varies with grade of ore.

<sup>4</sup>Varies with transportation and milling costs; a \$50,000 exemption.

### TRANSACTIONS

Three sales transactions were concluded this month. One sale from a US producer to a US utility involved between 100,000 and 300,000 pounds U<sub>3</sub>O<sub>8</sub>, with delivery to take place in the latter half of 1981. Another sale was made from a US producer to a US nuclear contractor for delivery near the end of 1981. The quantity involved was 100,000 to 300,000 pounds U<sub>3</sub>O<sub>8</sub>. Finally, a European based producer sold between 100,000 to 300,000 pounds U<sub>3</sub>O<sub>8</sub> to a European utility with delivery to occur early in 1981.

### PRICING

While there were indications of continued weakening of the uranium market this month, sufficient activity took place at the \$28.00 level to allow the Exchange Value to remain unchanged.

Current demand is still composed of discretionary buyers, utilities purchasing for inventory and producers buying rather than making to fulfill existing

# URANIUM MARKET

commitments. The sellers in this market are primarily inventory holders seeking to generate revenue or reduce inventory levels. There are also large quantities of material available from producers. Total uranium available for sale (see Market Opportunities section of this Report) and delivery within the next year is about 8.4 million pounds U<sub>3</sub>O<sub>8</sub> equivalent, of which about 2.1 million pounds are available from primary producers. The total of active inquiries to buy for delivery within the next year has dropped to only 200,000 pounds U<sub>3</sub>O<sub>8</sub>. While this imbalance is great enough to have precipitated major drops in the Exchange Value in the past, there has been little evidence so far of sellers offering at major price concessions in order to move material. However with the end of the year approaching, some sellers may want to close spot sales this month in order to include them in fiscal 1980 results. This fact, combined with the present severe market imbalance, might put some downward pressure on the market.

Spot and near term inquiries to sell and inquiries to purchase, as published by Nuexco in 1980, are tabulated in Table 2. The differences between the two, the supply excesses, are also tabulated. The supply excess increased to above three million pounds U<sub>3</sub>O<sub>8</sub> in early 1980, and generally remained at about three million pounds throughout 1980, until it increased to 6.3 million pounds in November, and 8.2 million pounds this month. The effect of this supply imbalance on price will depend on how aggressively the sellers attempt to market their material. As yet, there has been little indication of serious price cutting. However the absence of active buyers in the spot and near term markets might lead to price cutting if new buyers are to be attracted into the market.

Another indication of the weakened market is the manner in which some contracts for intermediate term delivery are being priced. Until recently, sales for delivery more than about one year after contract signature were either priced at market at time of delivery, or at an escalated price or some combination.

Now, however, transactions are closing at fixed prices for delivery and payment in late 1981 and 1982.

The *Transaction Value* decreased slightly this month to \$28.70 per pound U<sub>3</sub>O<sub>8</sub>, from \$29.00 last month.

Table 2  
SPOT AND NEAR TERM SUPPLY AND  
DEMAND FIGURES PUBLISHED  
BY NUEXCO DURING 1980

| Nuexco<br>Report<br>Number | Spot and Near Term Inquiries<br>(Millions of Pounds U <sub>3</sub> O <sub>8</sub> ) |                |            | Exchange<br>Value<br>(\$ lb U <sub>3</sub> O <sub>8</sub> ) |
|----------------------------|-------------------------------------------------------------------------------------|----------------|------------|-------------------------------------------------------------|
|                            | To<br>Sell                                                                          | To<br>Purchase | Difference |                                                             |
| 137                        | 3.75                                                                                | 2.45           | 1.3        | 40.75                                                       |
| 138                        | 4.13                                                                                | 2.05           | 2.1        | 40.00                                                       |
| 139                        | 4.08                                                                                | 0.50           | 3.6        | 38.00                                                       |
| 140                        | 4.05                                                                                | 1.00           | 3.1        | 35.00                                                       |
| 141                        | 3.75                                                                                | 1.90           | 1.9        | 32.00                                                       |
| 142                        | 4.20                                                                                | 1.20           | 3.0        | 32.00                                                       |
| 143                        | 4.10                                                                                | 0.75           | 3.4        | 31.50                                                       |
| 144                        | 3.33                                                                                | 0.23           | 3.1        | 31.50                                                       |
| 145                        | 3.95                                                                                | 0.17           | 3.8        | 30.00                                                       |
| 146                        | 4.73                                                                                | 2.05           | 2.7        | 28.50                                                       |
| 147                        | 7.45                                                                                | 1.10           | 6.3        | 28.00                                                       |
| 148                        | 8.40                                                                                | 0.20           | 8.2        | 28.00                                                       |

## CONVERSION

As indicated in last month's Nuexco Report, the secondary market for conversion services is being dominated by inventory holders wishing to sell material in the form of UFe. Since most buyers are interested in purchasing uranium in the form of concentrates, these inventory holders are offering low prices on conversion services in order to "deconvert" the UFe inventories. Nuexco is currently seeing inventory holders making offers to sell spot conversion services at prices in the range of \$1.00 per pound U as UFe.

COMMENTARY

NUCLEAR POWER AND THE NEW POLITICAL ENVIRONMENT

by J. R. Wolcott\*

The 1980 elections are over. We now know that Mr. Reagan will be President. We will have a Republican controlled Senate and a Democratic controlled House of Representatives. President-elect Reagan's position is expected to be firmer than President Carter's equivocal classification of nuclear as a "last resort." The more conservative Congress will tilt to a concern with what is *practical*, and less with what is only *theoretically* desirable.

Frequently asked questions are: "How soon will President Reagan turn the situation around?" "How soon will we see a resurgence of new plant orders?" and "How soon will this impact upon the uranium business?" Questions of 't' at type are the main subject of my comments today.

I should comment at the outset that my view is generally that of a short range pessimist and a long term optimist. The near term problems I foresee are too deep-seated for a quick turnaround. On the other hand, we do have a better political climate which may allow for actions beneficial in the long term.

We have to bear in mind the many problems facing the forthcoming administration. The counter forces remain, even if their White House influence is not as great. The President will have to allocate much of his attention to problems requiring solution now—taxes, inflation, overregulation, unemployment, defense and so on.

The first specific problem the government must come to grips with involves risks to private investors where those risks originate with government itself. A referendum was held in Maine this year. Forty percent of the voters favored a shut-down of the state's only operating nuclear power plant. Three presidential aspirants—Anderson, Brown and Kennedy—conducted anti-nuclear campaigns. Political pundits predict all three candidates will be back in 1981. This is not a climate which spawns enthusiastic investors.

A two-unit nuclear power station requires the investment of four to five billion dollars. That is more than the total value of the common equity of

many major companies including Bank of America, Bell Telephone of Canada, and International Telephone & Telegraph. Investments of that magnitude are taken especially seriously when political whim is important.

A nuclear project started this year would accumulate several hundred million dollars in expenditures by 1984. Uncertainty would not end there. A project requires ten years for completion, and plant operations span 40 to 50 years. A dozen political changes are to be expected. Any one could be fatal from an investor's point of view.

If you were an utility director, you would think carefully about uncertainties for shareholders. The prudent utility course is usually the low risk course. Under today's conditions, nuclear power is not the low risk course.

Making nuclear power an attractive investment therefore requires reducing financial risks associated with political risks to acceptable levels. Only government can protect from the consequences of government. And moreover, Congressional action is required; the President cannot act alone. Congressional action requires time.

The second major obstacle is utility financing. Even assuming the political risk problem is solved, financial hurdles remain. Any utility using replacement type cost accounting would almost certainly show that it is actually liquidating, rather than generating, the capital needed to finance tomorrow's business. The capital shortage is further aggravated by government and public utility commission pressures to channel resources into capital intensive, low revenue producing systems, such as windmills, interest-free loans for insulation, and similar measures. Utility projects already committed will require more than 50 billion dollars per year during the 1980's.

A third major problem is reorganization of the whole nuclear power industry. Will an industry that took shape in the 1950's, was essentially eclipsed in 1975, and has become embroiled in political controversy ever since, re-emerge in the old conceptual framework? I do not think so. Major structural changes are likely in every facet of the business—site location, forms of ownership, financing, industry roles, government roles, technical relationships, reg-

\*This Commentary is the text of an address by J. R. Wolcott, President, Nuexco, at the Nuexco Luncheon, Atomic Industrial Forum Annual Meeting, Washington, D.C., November 17, 1980.



## COMMENTARY

ulatory approaches, and so on. The new concept is not ready. We have got to get it ready.

Recent examples illustrate the possible breadth of restructuring of the industry. People are thinking in terms unthinkable five or ten years ago. A privately-owned utility president has suggested nationalization of nuclear power generation. Another utility leader has suggested confining nuclear power plant operations responsibilities to select large utilities. The USNRC is considering site criteria limiting plant locations to areas with population densities of less than 500 persons per square mile in a 30-mile radius. This is only the tip of the iceberg.

Forces are at work which do encourage action. It obviously does not make sense to use oil to generate electricity. The entire US national power plant oil inventory may be less than ninety days' supply. Stockpiled US uranium, on the other hand, is adequate at current consumption rates for ten years.

Electricity shortages will be more of a problem. It is not clear when a high degree of visibility will emerge. The national shortage will be an accumulation of regional shortages. Some early increments can already be seen. Aluminum plants have been shut down in the Northwest. California is preparing for automatic shut-off of air conditioners. A national shortage will not appear as a single thunderclap, but as a growing aggravation.

A recognized shortage of electric generation does not necessarily guarantee constructive action. Political considerations usually split opinions along two lines. One line favors *free market mechanisms*, so that shortages are *alleviated*. The other favors *regulatory mechanisms*, so that shortages are *managed*. For example, you may have noticed that polls indicate half the population favors gasoline rationing while the other half favors allowing prices to govern. The new President is obviously ideologically committed to free-market mechanisms. The entire US public is not.

One cannot be certain of the ultimate outcome even when government does act. Mismatches between intentions and consequences abound. President Carter's "Moral Equivalent of War" turned out to be a new tax. As Pogo said, "We met the enemy and he was us." We, the enemy, received a new 200 billion dollar tax bill, not a solution to the energy policy problem.

A recent story illustrates more concretely the

possible gap between intentions and results. The story, so it goes, was that our three presidential candidates were captured by revolutionaries and sentenced to execution. Reagan was first. As the firing squad prepared to fire, he yelled "Earthquake" and escaped. Congressman Anderson, a resourceful fellow, yelled, "Flood," and escaped in the chaos. Next was President Carter, who learned from examples of Reagan and Anderson. When the firing squad was ready, Carter yelled, "Fire."

I would like to add a word about our international situation. A major rebuilding job is to be done if we are to rejoin the world community, to say nothing of leading it.

I have traveled overseas on nuclear business since 1955 on more than 100 trips. I have observed a complete reversal of the US nuclear power position. The US program was initially admired and copied in almost every respect, from technology to public policy. Then we decided to forge our own rules; the world reacted and decided to forge its own. This led to policies aimed at reducing foreign dependence upon the US. One result, for example, is more reluctance to rely upon US uranium and enrichment supply.

Our technological advantage has diminished. Others are moving ahead. The Japanese, as one example, are continuing to develop. By 1990 Japan may hold the lead in the nuclear power technology just as it does today in automobiles. If so, let's remember that we did it to ourselves.

I have described major problem areas of political risk, capital shortages, industry reorganization, government realignment, and the uncertainty of government response. All have to be tackled by the Administration and Congress. The President needs help.

If I were asked for my advice to the President, it would be as follows:

*First*, end White House indifference to nuclear power. We cannot hold our own, much less lead the world if we view nuclear power as a "last resort."

*Second*, redefine the role of government to be functional, both in furthering programs already cast, and in the new government-industry structure required for expansion.

*Third*, take those steps the federal government can take to place utilities on a sound financial basis so that nuclear power will not be stalemated by finan-

COMMENTARY

cial obstacles once other obstacles are removed.

*Fourth*, obtain legislation to protect the private investor from government actions over which he has no control.

*Fifth*, return to a policy of "international pragmatism." Abandon the flawed policy of "moral imperialism." Return to functioning within the world community rather than pursuing a course which isolates the United States.

*Sixth*, establish a visible institution for waste management. Make certain this institution meets the public need for appearance as well as substance. Something along the lines of the Syntel Corporation may be appropriate.

I do not believe even these actions, or any other government actions, would result in an immediate burst of orders for new nuclear units. It is the utilities who must finally act. Actions along the above lines, however, would lay a foundation. A "greening" of nuclear power might begin in the mid-1980's. The test of the new Administration is not whether it can convince utilities that they should proceed with nuclear power plant purchases the next year or two. That is not practical. More time is required. The real test is whether a new political alignment can be

created that will result in a workable legal and regulatory foundation. Once that is done the future can develop. If that is not done the next four years, then we will enter the back half of the 1980's no closer to a solution than we are today. I would not view President Reagan's nuclear power program as a failure simply because new starts are not made within his term. I would view the program as a failure if provisions are not made on which to build for the future. The action described herein may not be as visible and impressive as we would like. Waiting is frustrating. Frustration is a fate to which we in the nuclear business seemed destined. But it is not a bad lot.

A while ago I asked one of our bright young brokers who joined us after graduating from Stanford, whether she was bothered by the political and social turmoil associated with nuclear power. Our headquarters are located, as you know, on the perimeter of the Stanford campus. "Oh, no," she said, "nuclear power is at the eye of the whole political and social storm. I wouldn't want to be anywhere else." Intuitively, I have always felt the same way. Her perspective, nevertheless, helped my morale and my patience.



## RAW MATERIALS

## THE SCHWARTZWALDER MINE

## Introduction

Approximately 98 percent of known uranium resources in the US occur as bedded deposits in sandstone formations primarily of Triassic, Jurassic and Tertiary Age. The remaining two percent occurs as vein deposits in older metamorphic and igneous rocks. The Schwartzwald deposit in Colorado is the largest and most productive deposit in the latter category. The Midnight deposit located near Spokane, Washington and the Pitch deposit located near Marshall Pass, Colorado are the only other vein-type deposits currently being mined.

The Schwartzwald is one of many uranium occurrences found along the Colorado Front Range west of Denver, Colorado. In fact, there are at least 30 known uranium occurrences along a stretch of the Front Range starting about 25 miles southwest of Denver and extending to the northwest approximately 60 miles. Of these occurrences, 13 are found in Proterozoic metasediments that make up the foothills of the Front Range. Another 11 are in Precambrian crystalline rocks that form the core of the range. The three remaining occurrences are located in Cretaceous sandstones adjacent to the metamorphic rocks. Figure 1 is a map of the Front Range showing the location of the Schwartzwald Mine in relation to the other uranium occurrences and the Colorado Mineral Belt.

The deposits in sediments and metasediments have been mined solely for uranium. The Schwartzwald is an exception. In crystalline rocks, uranium usually occurs in minor association with other minerals. Originally, the uranium was discarded along with waste rock during the mining process of other minerals.

The important uranium mineralization at the Schwartzwald occurs primarily in fissure veins along faults and fractures in the metasediments and crystalline rocks. Disseminated mineralization in pegmatite dikes is of secondary importance. The main uranium minerals present are pitchblende and coffinite—both primary minerals found in the unoxidized portion of the deposits. The uranium minerals autunite, torbernite and uranophane have been mined from the oxidized zone of various deposits. Pitchblende is the main uranium mineral at the Schwartzwald mine.

## History

Most of the uranium sites noted on Figure 1 were prospected for sulfides and precious metals during the 1800's. However it was not until about 1871 that pitchblende was identified as an accessory mineral in several gold mines of the Central City mining district. Thereafter, uranium was recognized in many mines and prospects throughout the Front Range. Small quantities of uranium were produced intermittently from various mines, primarily from the Central City district.

The US Geological Survey began evaluation of all known uranium occurrences in the Front Range in the late 1940's. The presence of the Survey stimulated interest in the area. This resulted in additional discoveries and higher production by the early 1950's.

The Schwartzwald deposit was discovered in 1949 at the site of an old copper gold prospect pit. The secondary mineral torbernite was recognized in alteration cavities and fractures. Chemical assays of samples taken from the pit contained up to 0.70 percent U<sub>3</sub>O<sub>8</sub>. Pitchblende was later recognized as the main ore mineral present.

It was determined from early prospecting that uranium mineralization at the Schwartzwald deposit was confined to veins in a near-vertical fault zone. The first ore mined came from small surface pits and an adit driven horizontally across the mineralized zone which proved to be several hundred feet wide. The first ore shipments were made to the Viro Chemical mill at Salt Lake City in November 1953. Thereafter the property developed rapidly as an underground mine.

The Schwartzwald mine was acquired by the Denver Golden Oil and Uranium Company in 1956. The Cotter Corporation acquired the property in 1965. Cotter discovered additional ore reserves and initiated a mine plan to develop the deeper ore zones along the main fault. The Cotter Corporation became a wholly-owned subsidiary of Commonwealth Edison Company in 1974. All production has been processed at Cotter's Canon City mill since 1958. Total production to date from the Schwartzwald Mine is approximately 11.5 million pounds U<sub>3</sub>O<sub>8</sub>. Figure 2 is a photograph of the surface facilities at the Schwartzwald Mine.

## RAW MATERIALS

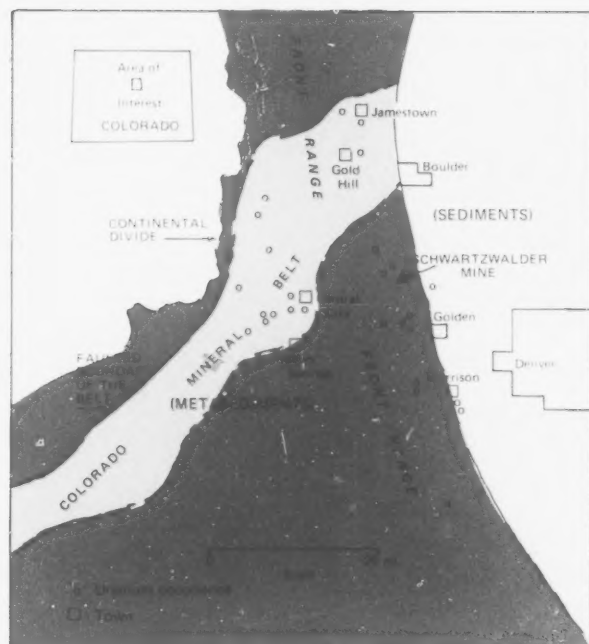


**Figure 1**  
**LOCATION MAP OF THE**  
**SCHWARTZWALDER MINE WITH RELATION**  
**TO KNOWN URANIUM OCCURRENCES AND**  
**THE COLORADO MINERAL BELT IN THE**  
**CENTRAL PART OF THE FRONT RANGE.**

### District Geology

Uranium mineralization in the Front Range occurs exclusively in veins within metamorphic and igneous rocks and locally disseminated in pegmatite dikes. However, the occurrences in the metamorphic rocks are of first importance economically. Uranium production from deposits in other rock types generally has been of secondary importance to other minerals and actual quantities recovered are comparatively small.

That portion of the Front Range consists almost entirely of the Idaho Springs Formation which consists of Precambrian metasedimentary and metavolcanic rocks of the Lower Proterozoic Era (2,000 to 1,800 million years in age). The Idaho Springs Formation was intruded by granitic rocks and underwent further metamorphism and structural change during Proterozoic time and again during the Laramide

orogeny (late Cretaceous and early Tertiary). Numerous northwest trending faults and complex folds were created and remained active during each stage of intrusion and metamorphism.

The structural features of the metallogenic Colorado mineral belt formed at the same time. The mineral belt is separated from the northwest structural pattern of the range by a narrow northeast structural belt characterized by granitic and dike intrusions. Gold and silver deposits which formed during the Laramide orogeny have been mined throughout the extent of the mineral belt. However, no commercially important uranium deposits have been located within the limits of the belt (see Figure 1). Even so, all mineralization known in the Front Range province is nearly always associated directly with faulting and related structural features such as brecciation and fracturing. Figure 3 is a geologic and structural map of the Schwartzwalder mine area.

### Mine Geology

The metasediments at the Schwartzwalder mine have been faulted and folded to form a syncline which plunges to the west. Large segments of rock along the fault zones were intensely brecciated and fractured to form "open channel ways" which allowed the passage of mineral-bearing solutions. The Schwartzwalder orebody is confined to such a breccia zone on the Rogers shear system, one of five major northwest trending structures along the Front Range. The breccia zones vary from less than one foot to complex "horsetail" zones about 1,000 feet in width. The well cemented breccia zones (ankerite and quartz are the main cementing agents) are referred to as "breccia reefs." The cementing process is considered to be the first stage of mineralization to take place along the structure. Uranium mineralization was absent during this period.

It is postulated that the breccia zones were tightly cemented during the Lower Proterozoic orogeny, only to be refractured and reopened by additional movement, probably during Middle Proterozoic and Laramide time. Uranium deposits formed where uranium-bearing solutions flooded the reopened breccia zones. There is evidence in the mine suggesting that early uranium deposits may have experienced a certain amount of remobilization and that uranium was redeposited during a later phase of the Laramide mineralizing process.

RAW MATERIALS



Figure 2  
SURFACE FACILITIES AT THE SCHWARTZWALDER MINE.

## RAW MATERIALS

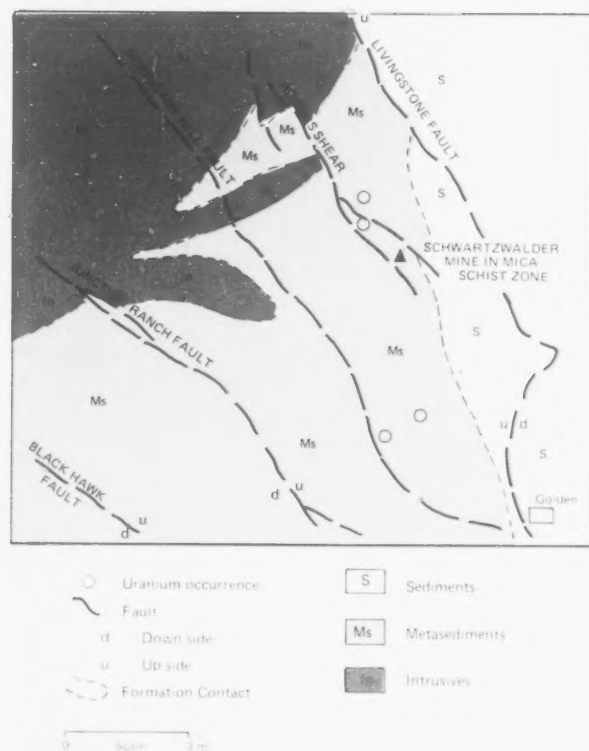


**Figure 3**  
**GEOLOGIC AND STRUCTURAL MAP OF**  
**THE SCHWARTZWALDER MINE AREA.**

Pitchblende is the dominant ore mineral and is deposited as rich veins in the open spaces of intensely fractured breccia along fault planes and intersections in the complex fault system. The main ore zones occur along the hangingwall of the westerly dipping Illinois fault which is a segment of the Rogers shear system, and associated hangingwall faults forming "horsetail" vein patterns that dip easterly into the Illinois fault. Figure 4 is an east-west vertical section through the mine showing the present mine workings with relation to the structural configuration of the deposit. Ore deposition is completely controlled by the Illinois and related structures.

The important host rocks for the ore are garnet-biotite gneiss, quartz-biotite schist and massive quartzite. Vein-filling quartzite and pegmatite dikes occasionally carry ore values in certain parts of the mine. However, the quartz-biotite schist is by far the

most important host. An estimated 70 percent of the ore occurs in the east dipping horsetail veins; the remainder occurs along the steeper Illinois and related faults (see figure 4).

The important accumulation of uranium at the Schwartzwalder deposit and other Front Range deposits, probably took place during the Laramide orogeny. If so, the age of mineralization is 70 to 60 million years. The mode of accumulation is considered to be hydrothermal—i.e., uraniferous hot waters ascended along the open faults from great depths to deposit the uranium in the open spaces within the favored host rock.

### Mining Procedures

Initial mine development consisted of driving five adits into the outcrop area of the Illinois fault. The three upper adits were intended more for exploration than mining and each was soon abandoned. However, the two lower adits were driven straight into the breccia zone for a distance of almost 700 feet. The Steve adit remains as the main access to the lower mine workings.

The mine has been developed to the 19th level below the Steve level, a depth of 2,000 feet. The Steve level is joined to the 8th level by the No. 1 shaft, and to the 11th level by the No. 2 shaft. An 8-foot diameter raise bore hole was drilled about 1,100 feet west of the mine to exhaust the lower mine levels (see Figure 4).

The principal vein structures are designated by names, letters and numbers in order to record ore type and grade, and mining progress. The main vein is along the Illinois fault which bifurcates to form the Washington fault from the 7th level to the surface and develops into a rich vein segment from the 11th level to below the 19th level. The horsetail veins extend upward from the Illinois at an angle of 30 to 70 degrees. The important vein configurations are shown on Figure 4.

Mining methods depend upon the characteristics of each vein. Throughout the upper levels in the more gently dipping horsetail veins, the ore is prepared for blasting by conventional jackleg drilling. The broken ore is moved by slushers, trackless loaders and Youngbuggies. The steeper veins are mined by shrink stope methods using jacklegs and stopers. The broken ore (and waste) must be transferred at least twice from the lower levels to the surface. The transfer is made by utilizing one yard front end loaders.

## RAW MATERIALS

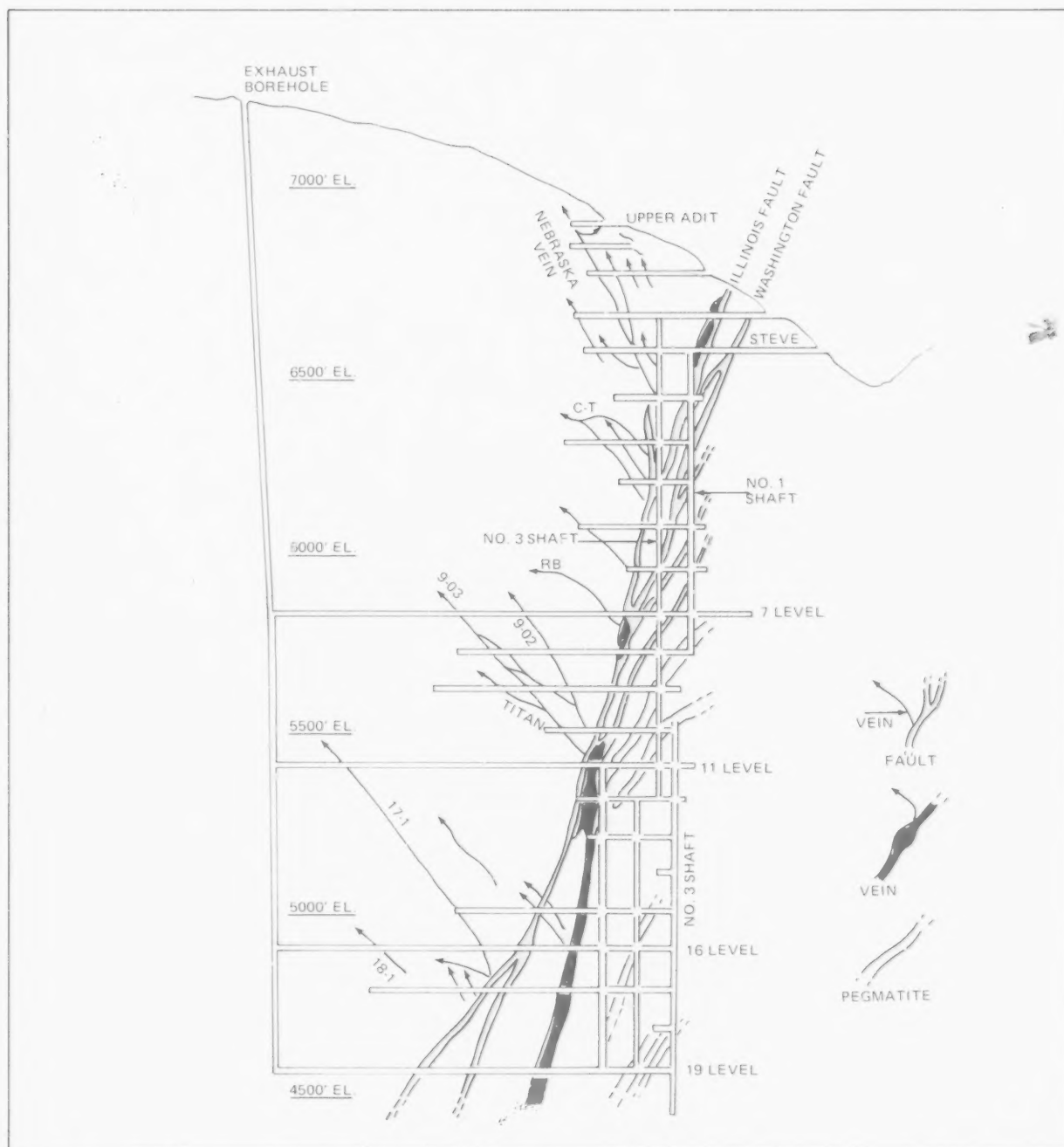


Figure 4  
 VERTICAL SECTION THROUGH THE SCHWARTZWALDER MINE WORKINGS, JANUARY, 1980,  
 SHOWING RELATIONSHIP OF THE HORSETAIL VEIN STRUCTURES TO THE ILLINOIS FAULT



## RAW MATERIALS

Cotter Corporation has devised a special technique for upgrading the ore after it is delivered to the surface. An electronic analyzer has been put into service to improve the grade of ore to be shipped to the mill. The analyzer is properly referred to as an "ore sorter." Figure 5 is a photograph of the ore sorter building and conveyor belt system which delivers all mined ore through the sorter after it has been crushed, washed and sized to 1-3 inches. The washed fines are automatically delivered to the ore stockpile. The function of the sorter is to analyze each rock fragment photometrically and radiometrically. Rock fragments that fit within optimum mass and radioactivity parameters, are air-blasted off the traveling belt onto an ore pile. Any fragments remaining on the belt drop onto a waste pile. The sorter is preset to optimize ore grade by discriminating against low

grade material. It effectively operates at a 30 percent reject rate sorting out rock of 0.02 percent U<sub>3</sub>O<sub>8</sub> or less. The sorter was installed in 1976 and it has been extremely effective in producing a net saving to Cotter Corporation relative to a direct reduction in the amount of ore transported and milled at the Canon City mill.

After the ore has passed through the sorter, it is stockpiled at a site four miles from the mine for later shipment to the Cotter mill at Canon City, 115 miles to the south. The expanded Cotter mill began operation in September 1979. Mill capacity is 1,200 tons per day. About 100 tons of Schwartzwalder ore are processed per day to produce an estimated 100,000 pounds U<sub>3</sub>O<sub>8</sub> annually. Remaining mill capacity is supplied from the Cotter properties located in the Utah-Colorado area of the Colorado Plateau district.

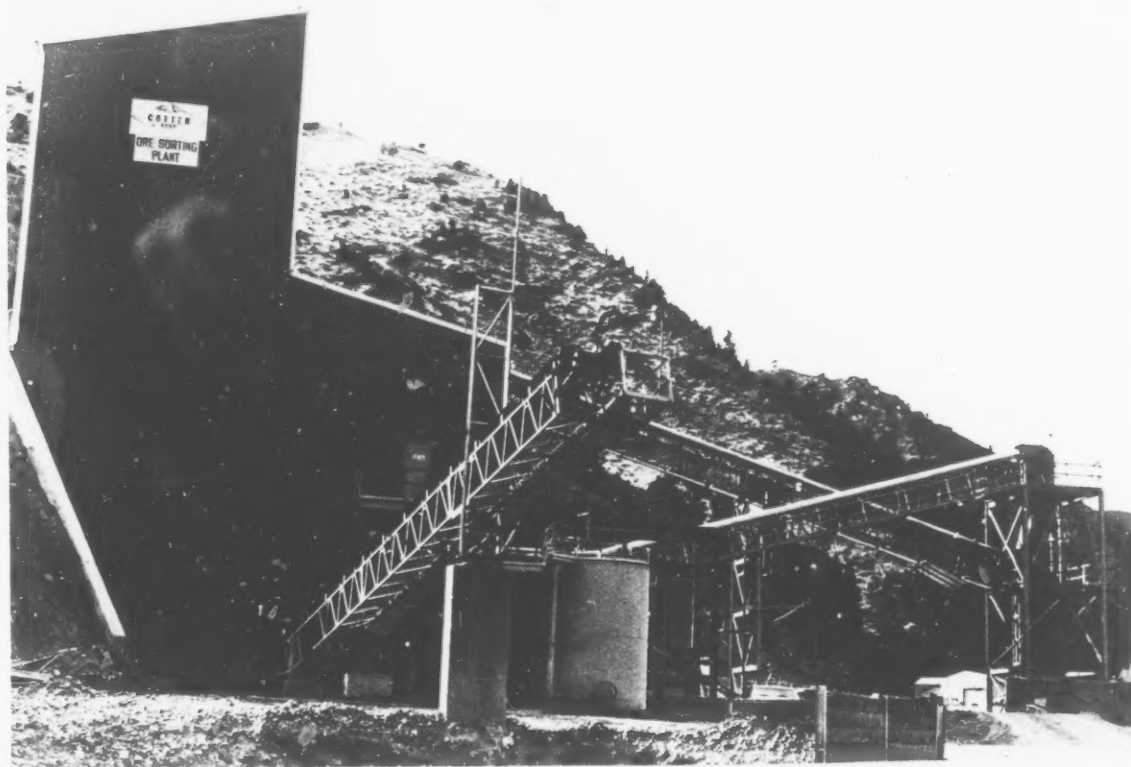


Figure 5  
ORE SORTER BUILDING AT SCHWARTZWALDER MINE.



# STATISTICAL DATA

**EXCHANGE VALUE—\$28.00/lb U<sub>3</sub>O<sub>8</sub>**  
Determined as of November 30, 1980

## Definition

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

## Derivation

Nuexco bases the Exchange Value upon:

- Data from recently completed transactions.
- Data from pending transactions.
- Firm bids to buy and firm offers to sell.
- Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

## Comments

Nuexco does not consider the following in determining the Exchange Value:

- The price of uranium delivered or to be delivered under old contracts.
- The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

| TRANSACTION VALUE                   |                    |                        |                  |
|-------------------------------------|--------------------|------------------------|------------------|
| Determined as of November 30, 1980  |                    |                        |                  |
| \$ lb U <sub>3</sub> O <sub>8</sub> | Millions of Pounds | Number of Transactions | Number of Months |
| 28.70                               | 2.9                | 16                     | 4                |

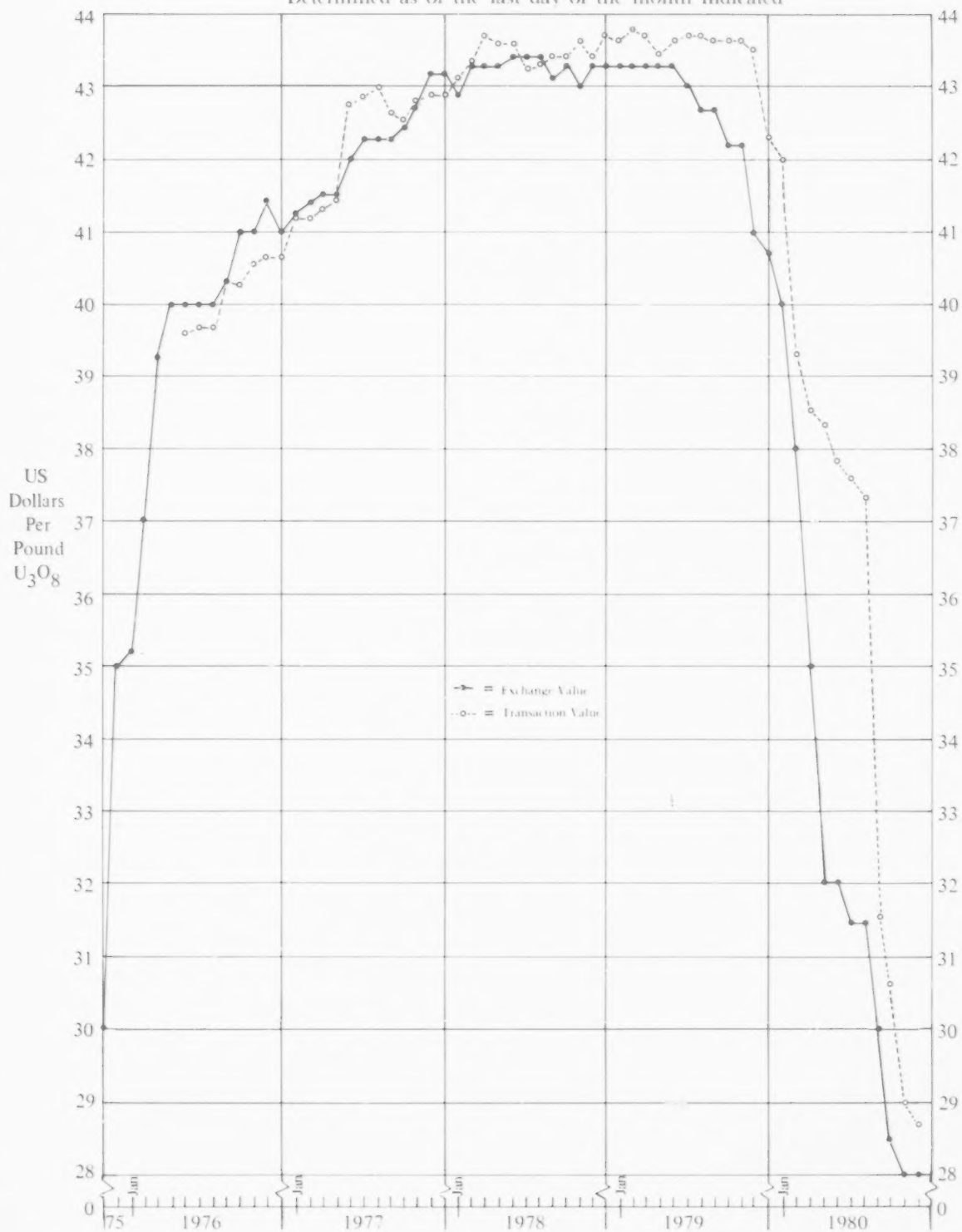
## Definition

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U<sub>3</sub>O<sub>8</sub> in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds U<sub>3</sub>O<sub>8</sub> are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

STATISTICAL DATA

EXCHANGE AND TRANSACTION VALUES  
SINCE NOVEMBER 1975

Determined as of the last day of the month indicated



# STATISTICAL DATA

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated

(U.S. Dollars lb. U.S.Os)

|      | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1968 | —     | —     | —     | —     | —     | —     | —     | 6.35  | 6.35  | 6.40  | 6.45  | 6.50  |
| 1969 | —     | 6.35  | 6.10  | 6.10  | 6.25  | 6.25  | 6.20  | 6.20  | 6.15  | 6.15  | 6.15  | 6.20  |
| 1970 | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.20  | 6.15  | 6.15  | 6.15  | 6.15  |
| 1971 | 6.20  | 6.20  | 6.20  | 6.20  | 6.15  | 6.05  | 6.00  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  |
| 1972 | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  |
| 1973 | 5.95  | 6.00  | 6.10  | 6.20  | 6.45  | 6.50  | 6.50  | 6.50  | 6.50  | 6.50  | 6.75  | 7.00  |
| 1974 | 7.70  | 7.90  | 8.00  | 9.00  | 9.50  | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 |       |

**Note:** See earlier Nuexco Reports for evolution of the definition of Exchange Value.

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated

(U.S. Dollars lb. U.S.Os)

|      | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1976 | —     | —     | —     | —     | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 |       |

**Note:** See Nuexco Report 135 for a discussion of the definition of Transaction Value.

STATISTICAL DATA

EXCHANGE VALUE EXPRESSED IN SELECTED  
PRODUCER & CONSUMER CURRENCIES\*

| Country             | per lb U <sub>3</sub> O <sub>8</sub><br>in Concentrates | per kg U <sub>3</sub> O <sub>8</sub><br>in Concentrates | per kg U<br>in Concentrates |
|---------------------|---------------------------------------------------------|---------------------------------------------------------|-----------------------------|
| US (dollar)         | 28.00                                                   | 61.73                                                   | 72.79                       |
| France (franc)      | 124.28                                                  | 273.99                                                  | 323.10                      |
| FRG (mark)          | 53.51                                                   | 117.96                                                  | 139.11                      |
| Japan (yen)         | 5,994                                                   | 13,215                                                  | 15,584                      |
| Switzerland (franc) | 46.69                                                   | 102.93                                                  | 121.38                      |
| UK (pound)          | 11.84                                                   | 26.11                                                   | 30.79                       |
| Australia (dollar)  | 24.01                                                   | 52.94                                                   | 62.43                       |
| Canada (dollar)     | 33.30                                                   | 73.41                                                   | 86.57                       |
| Niger, Gabon (CEA)  | 6,214                                                   | 13,699                                                  | 16,155                      |
| South Africa (rand) | 21.02                                                   | 46.34                                                   | 54.65                       |

\*Calculated using currency exchange rates published in the Wall Street Journal on the last business day of the month.

LOAN USE CHARGE RATE—7.0% year

Definition

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

Derivation

Nuexco bases the Loan Use Charge Rate upon:

- Data from recently completed or pending loan transactions.
- Rates included in firm proposals to borrow or lend.
- Rates that potential borrowers and lenders have expressed a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

## STATISTICAL DATA

## CURRENT TRANSACTIONS\*

| Nuexco<br>Reference<br>Number | Delivery<br>Period | Approximate Quantity<br>(thousands of pounds,<br>£10s equivalent) | Approximate<br>Price as<br>percent of<br>Current E.V. | Seller<br>Group | Buyer<br>Group | Remarks |
|-------------------------------|--------------------|-------------------------------------------------------------------|-------------------------------------------------------|-----------------|----------------|---------|
| 1279                          | 81                 | 101 - 300                                                         | 102                                                   | US              | US             |         |
| 1287                          | 81                 | 101 - 300                                                         | 100                                                   | US              | US             |         |
| 1288                          | 81                 | 101 - 300                                                         | 100                                                   | Europe          | Europe         |         |

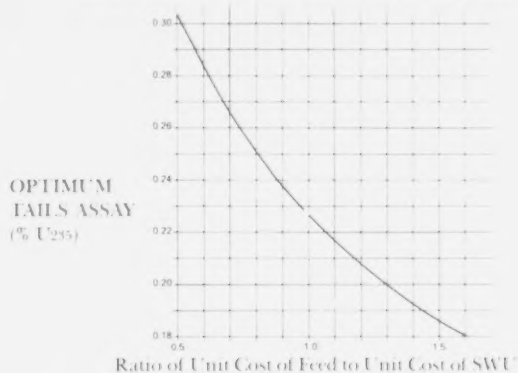
\* Transactions listed include not only those in which Nuexco was involved, but also all others of which Nuexco is aware.

STATISTICAL DATA

OPTIMUM TAILS ASSAY

The optimum tails assay is the tails composition at which the cost of enriched uranium is lowest for given costs of separative work (SWU) and natural uranium feed. It depends only on the ratio of the cost of a kilogram of natural uranium in the form of  $U_6$  to the cost of a kilogram unit of separative work. The US Department of Energy (USDOE) Adjustable Fixed Commitment (AFC) enrichment contract holders have the option, within limits, to specify the transaction tails assay. The transaction tails assay for USDOE Requirements contracts is 0.2 percent  $U_{235}$ . For every one-hundredth of one percent increase in the transaction tails assay, uranium consumption increases about two percent.

TAILS ASSAY FOR MINIMUM COST OF PRODUCT\*



\*From Nuexco Report 138

OPTIMUM TAILS ASSAY<sup>1</sup>



<sup>1</sup>Based on Exchange Value and USDOE AFC SWU price; interpolated to the nearest thousandth.



## STATISTICAL DATA

## US GOVERNMENT STATISTICS

|                                 | Producer Price<br>Index—Industrial<br>Commodities<br>(1967 = 100) <sup>1</sup> | Consumer<br>Price<br>Index<br>(1967 = 100) <sup>2</sup> | GNP<br>Implicit<br>Price<br>Deflator<br>(1972 = 100) <sup>3</sup> | Gross Average Hourly Earnings<br>of Production or Non-supervisory<br>Workers (US\$) <sup>4</sup> |                                               |                                                 |
|---------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------|
|                                 |                                                                                |                                                         |                                                                   | Metal<br>Mining<br>(SIC 10)                                                                      | Primary<br>Non-ferrous<br>Metals<br>(SIC 333) | Chemicals<br>and Allied<br>Products<br>(SIC 28) |
| Annual Avg. 1970 <sup>(5)</sup> | 110.0                                                                          | 116.3                                                   | 91.36                                                             | 3.88                                                                                             | 3.87                                          | 3.69                                            |
| Annual Avg. 1971 <sup>(5)</sup> | 114.1                                                                          | 121.3                                                   | 96.02                                                             | 4.12                                                                                             | 4.15                                          | 3.97                                            |
| Annual Avg. 1972 <sup>(5)</sup> | 117.9                                                                          | 125.3                                                   | 100.00                                                            | 4.56                                                                                             | 4.59                                          | 4.26                                            |
| Annual Avg. 1973 <sup>(5)</sup> | 125.9                                                                          | 133.1                                                   | 105.80                                                            | 4.84                                                                                             | 4.98                                          | 4.51                                            |
| Annual Avg. 1974 <sup>(5)</sup> | 153.8                                                                          | 147.7                                                   | 116.02                                                            | 5.44                                                                                             | 5.63                                          | 4.88                                            |
| Annual Avg. 1975 <sup>(5)</sup> | 171.5                                                                          | 161.2                                                   | 127.15                                                            | 6.13                                                                                             | 6.24                                          | 5.39                                            |
| Annual Avg. 1976 <sup>(5)</sup> | 182.4                                                                          | 170.5                                                   | 133.71                                                            | 6.76                                                                                             | 6.87                                          | 5.91                                            |
| Annual Avg. 1977 <sup>(6)</sup> | 195.1                                                                          | 181.5                                                   | 141.70                                                            | 7.28                                                                                             | 7.67                                          | 6.43                                            |
| Annual Avg. 1978 <sup>(6)</sup> | 209.4                                                                          | 195.4                                                   | 152.05                                                            | 8.23                                                                                             | 8.56                                          | 7.02                                            |
| Annual Avg. 1979 <sup>(6)</sup> | 236.5                                                                          | 217.4                                                   | 165.46                                                            | 9.27                                                                                             | 9.49                                          | 7.60                                            |
| Aug 1979                        | 240.6                                                                          | 221.1                                                   | —                                                                 | 9.38                                                                                             | 9.70                                          | 7.66                                            |
| Sep 1979                        | 244.2                                                                          | 223.4                                                   | 167.20                                                            | 9.63                                                                                             | 9.79                                          | 7.74                                            |
| Oct 1979                        | 249.0                                                                          | 225.4                                                   | —                                                                 | 9.67                                                                                             | 9.87                                          | 7.83                                            |
| Nov 1979                        | 250.6                                                                          | 227.5                                                   | —                                                                 | 9.78                                                                                             | 9.85                                          | 7.88                                            |
| Dec 1979                        | 253.1                                                                          | 229.9                                                   | 170.58                                                            | 9.80                                                                                             | 9.92                                          | 7.92                                            |
| Jan 1980                        | 260.6                                                                          | 233.2                                                   | —                                                                 | 9.91                                                                                             | 10.06                                         | 7.97                                            |
| Feb 1980                        | 265.9                                                                          | 236.4                                                   | —                                                                 | 9.92                                                                                             | 10.01                                         | 8.01                                            |
| Mar 1980                        | 268.6                                                                          | 239.8                                                   | 174.48                                                            | 9.90                                                                                             | 10.22                                         | 8.05                                            |
| Apr 1980                        | 271.3R                                                                         | 242.5                                                   | —                                                                 | 10.00                                                                                            | 10.30                                         | 8.12                                            |
| May 1980                        | 272.9R                                                                         | 244.9R                                                  | —                                                                 | 10.18                                                                                            | 10.37                                         | 8.17                                            |
| Jun 1980                        | 273.5R                                                                         | 247.6                                                   | 178.93                                                            | 10.13                                                                                            | 10.69                                         | 8.24                                            |
| Jul 1980                        | 275.5                                                                          | 247.8                                                   | —                                                                 | 10.24                                                                                            | 10.82                                         | 8.35                                            |
| Aug 1980                        | 277.3                                                                          | 249.4                                                   | —                                                                 | 10.38                                                                                            | 10.78                                         | 8.39                                            |
| Sep 1980                        | 278.2P                                                                         | 251.7                                                   | 182.92                                                            | 10.49P                                                                                           | 10.90P                                        | 8.44P                                           |
| Oct 1980                        | 281.2P                                                                         | 253.9                                                   | —                                                                 | —                                                                                                | —                                             | 8.52P                                           |

P = Preliminary R = Revised since last month

(1) US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

(2) US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

(3) US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

(4) US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for January 1977 and beyond are adjusted to the March 1979 benchmark.

(5) Data for 1970-1976, monthly except for the GNP Implicit Price Deflator, and Price Index data for 1977-1978 appear on pages 16-18 of Nuexco Report 139.

(6) Employment and Earnings data for 1977-1979, monthly, appear on page 33 of Nuexco Report 147.

STATISTICAL DATA

AUSTRALIAN GOVERNMENT STATISTICS

|                                 | Price Index of Materials<br>Used in Manufacturing<br>Industry—All Groups<br>(Year 1968-69 = 100.0) <sup>1</sup> | Weighted Average<br>Minimum Weekly Wage<br>Rates—Adult Males<br>Australia<br>Mining and Quarrying (A\$) <sup>2</sup> |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Annual Avg. 1970 <sup>(3)</sup> | 101.4                                                                                                           | 59.88                                                                                                                |
| Annual Avg. 1971 <sup>(3)</sup> | 101.5                                                                                                           | 65.95                                                                                                                |
| Annual Avg. 1972 <sup>(3)</sup> | 105.6                                                                                                           | 71.26                                                                                                                |
| Annual Avg. 1973 <sup>(3)</sup> | 124.4                                                                                                           | 78.96                                                                                                                |
| Annual Avg. 1974 <sup>(3)</sup> | 141.9                                                                                                           | 108.07                                                                                                               |
| Annual Avg. 1975 <sup>(3)</sup> | 150.4                                                                                                           | 132.55                                                                                                               |
| Annual Avg. 1976 <sup>(3)</sup> | 168.4                                                                                                           | 160.93                                                                                                               |
| Annual Avg. 1977 <sup>(3)</sup> | 192.0                                                                                                           | 179.03                                                                                                               |
| Annual Avg. 1978 <sup>(3)</sup> | 215.4                                                                                                           | 190.04                                                                                                               |
| Annual Avg. 1979                | 248.5                                                                                                           | 196.34                                                                                                               |
| Jun 1979                        | 294.9                                                                                                           | 196.65                                                                                                               |
| Jul 1979                        | 298.2                                                                                                           | 199.22                                                                                                               |
| Aug 1979                        | 293.2                                                                                                           | 200.29                                                                                                               |
| Sep 1979                        | 302.4                                                                                                           | 201.10R                                                                                                              |
| Oct 1979                        | 309.4                                                                                                           | 200.56R                                                                                                              |
| Nov 1979                        | 310.4                                                                                                           | 199.91R                                                                                                              |
| Dec 1979                        | 319.4                                                                                                           | 200.71R                                                                                                              |
| Jan 1980                        | 340.1                                                                                                           | 215.75R                                                                                                              |
| Feb 1980                        | 345.6                                                                                                           | 215.18R                                                                                                              |
| Mar 1980                        | 340.3                                                                                                           | 214.81R                                                                                                              |
| Apr 1980                        | 327.9                                                                                                           | 215.12R                                                                                                              |
| May 1980                        | 335.1                                                                                                           | 214.71R                                                                                                              |
| Jun 1980                        | 338.4                                                                                                           | 214.04R                                                                                                              |
| Jul 1980                        | 349.1                                                                                                           | 221.34                                                                                                               |
| Aug 1980                        | 353.2P                                                                                                          | 219.62P                                                                                                              |
| Sep 1980                        | 351.7P                                                                                                          | 218.98P                                                                                                              |

P = Preliminary R = Revised since last month

- (1) Australian Bureau of Statistics, Canberra; "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.  
 (2) Australian Bureau of Statistics, Canberra; "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest fourteen months shown are subject to revision.  
 (3) Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

## STATISTICAL DATA

## CANADIAN GOVERNMENT STATISTICS

|                  | Industry Selling<br>Price Index:<br>Manufacturing<br>(D 500000) <sup>1,2</sup><br>(1971 = 100.0) | Wage-earner Data:<br>Average Hourly Earnings (C\$) <sup>3,4</sup> |                                                              |                                                        |
|------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------|
|                  |                                                                                                  | Metal Mining,<br>including<br>milling<br>(SIC 050-059)            | Primary Metal<br>Industries,<br>non-ferrous<br>(SIC 296-298) | Chemicals and<br>Chemical<br>Products<br>(SIC 370-379) |
| Annual Avg. 1977 | 174.3                                                                                            | 8.18                                                              | 6.50                                                         | 6.51                                                   |
| Annual Avg. 1978 | 190.4                                                                                            | 8.76                                                              | 6.82                                                         | 6.97                                                   |
| Annual Avg. 1979 | 217.9                                                                                            | 9.60                                                              | 7.35                                                         | 7.67                                                   |
| Jul 1979         | 218.3                                                                                            | 9.37                                                              | 7.34                                                         | 7.73                                                   |
| Aug 1979         | 220.0                                                                                            | 9.56                                                              | 7.38                                                         | 7.77                                                   |
| Sep 1979         | 223.4                                                                                            | 9.75                                                              | 7.50                                                         | 7.81                                                   |
| Oct 1979         | 227.4                                                                                            | 9.89                                                              | 7.54                                                         | 7.88                                                   |
| Nov 1979         | 228.1                                                                                            | 9.97                                                              | 7.61                                                         | 7.91                                                   |
| Dec 1979         | 230.4                                                                                            | 9.93                                                              | 7.51                                                         | 7.89                                                   |
| Jan 1980         | 239.0                                                                                            | 9.96                                                              | 7.57                                                         | 7.99                                                   |
| Feb 1980         | 240.8                                                                                            | 10.11                                                             | 7.69                                                         | 8.08                                                   |
| Mar 1980         | 239.5                                                                                            | 10.34                                                             | 7.83                                                         | 8.26                                                   |
| Apr 1980         | 241.0R                                                                                           | 10.40                                                             | 7.94                                                         | 8.36                                                   |
| May 1980         | 242.4R                                                                                           | 10.50                                                             | 8.01                                                         | 8.44                                                   |
| Jun 1980         | 243.7R                                                                                           | 10.51                                                             | 8.07                                                         | 8.46                                                   |
| Jul 1980         | 246.2R                                                                                           | 10.49P                                                            | 8.11P                                                        | 8.55P                                                  |
| Aug 1980         | 249.2                                                                                            | 10.59P                                                            | 8.17P                                                        | 8.62P                                                  |
| Sep 1980         | 251.5P                                                                                           | —                                                                 | —                                                            | —                                                      |

P = Preliminary    R = Revised since last month

(1) Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

(2) Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

(3) Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

(4) Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

STATISTICAL DATA

REPUBLIC OF SOUTH AFRICA STATISTICS

|                                 | Average Declared Working<br>Costs per Metric Ton of<br>Gold Ore Milled (Rand) <sup>(1)</sup> | Consumer<br>Price Index <sup>(2)</sup><br>(1975 = 100, except where<br>otherwise indicated) |
|---------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Annual Avg. 1970 <sup>(3)</sup> | 7.34                                                                                         | 100.3 <sup>(4)</sup>                                                                        |
| Annual Avg. 1971 <sup>(3)</sup> | 7.88                                                                                         | 106.4 <sup>(4)</sup>                                                                        |
| Annual Avg. 1972 <sup>(3)</sup> | 8.79                                                                                         | 113.3 <sup>(4)</sup>                                                                        |
| Annual Avg. 1973 <sup>(3)</sup> | 10.51                                                                                        | 124.1 <sup>(4)</sup>                                                                        |
| Annual Avg. 1974 <sup>(3)</sup> | 13.18                                                                                        | 138.5 <sup>(4)</sup>                                                                        |
| Annual Avg. 1975 <sup>(3)</sup> | 16.71                                                                                        | 157.2 <sup>(4)</sup>                                                                        |
| Annual Avg. 1976 <sup>(3)</sup> | 19.30                                                                                        | 174.7 <sup>(4)</sup>                                                                        |
| Annual Avg. 1977 <sup>(3)</sup> | 23.87                                                                                        | 194.4 <sup>(4)</sup>                                                                        |
| Annual Avg. 1978 <sup>(3)</sup> | 27.14                                                                                        | 137.2                                                                                       |
| Annual Avg. 1979 <sup>(3)</sup> | 30.18                                                                                        | 155.3                                                                                       |
| Aug 1979                        | —                                                                                            | 160.2                                                                                       |
| Sep 1979                        | 30.71                                                                                        | 162.1                                                                                       |
| Oct 1979                        | —                                                                                            | 162.9                                                                                       |
| Nov 1979                        | —                                                                                            | 163.4                                                                                       |
| Dec 1979                        | 31.89                                                                                        | 164.0                                                                                       |
| Jan 1980                        | —                                                                                            | 165.4                                                                                       |
| Feb 1980                        | —                                                                                            | 167.0                                                                                       |
| Mar 1980                        | 33.65                                                                                        | 168.0                                                                                       |
| Apr 1980                        | —                                                                                            | 170.0                                                                                       |
| May 1980                        | —                                                                                            | 171.9                                                                                       |
| Jun 1980                        | 34.48R                                                                                       | 174.6                                                                                       |
| Jul 1980                        | —                                                                                            | 177.2                                                                                       |
| Aug 1980                        | —                                                                                            | 179.2                                                                                       |
| Sep 1980                        | 36.19                                                                                        | 182.8                                                                                       |
| Oct 1980                        | —                                                                                            | 186.3                                                                                       |

(1) Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

(2) Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

(3) Historical data for 1970 through 1979 appear on page 4.9 of Nuexco Report 140.

(4) April 1970 = 100.00

# MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

## URANIUM SUPPLY

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U <sub>3</sub> O <sub>8</sub> ) |              |              | Remarks         |
|-------------------------------|--------------------------------------------------------------------------|--------------|--------------|-----------------|
|                               | 0 to 1 Year                                                              | 1 to 2 Years | 2 to 3 Years |                 |
| Available for Sale:           |                                                                          |              |              |                 |
| 1286                          | 150                                                                      | 150          | 150          | Long term       |
| 1392                          | 200                                                                      |              |              |                 |
| 1394                          | 1000                                                                     |              |              | UF <sub>6</sub> |
| 1475                          | 1000                                                                     |              |              | UF <sub>6</sub> |
| 1480                          | 500                                                                      |              |              |                 |
| 1481                          | 250                                                                      |              |              |                 |
| 1490                          | 1250                                                                     |              |              |                 |
| 1496                          | 350                                                                      |              |              |                 |
| 1533                          | 400                                                                      |              |              | UF <sub>6</sub> |
| 1534                          | 800                                                                      |              |              |                 |
| 1540                          | 750                                                                      |              |              | UF <sub>6</sub> |
| 1547                          | 100                                                                      |              |              |                 |
| 1550                          | 1000                                                                     |              |              | UF <sub>6</sub> |
| 1551                          | 150                                                                      |              |              |                 |
| 1552                          | 200                                                                      |              |              |                 |
| 1559                          | 300                                                                      |              |              |                 |
| TOTALS                        | 8400                                                                     |              |              |                 |
| Available for Loan:           |                                                                          |              |              |                 |
| 1355                          | 600                                                                      |              |              |                 |
| 1429                          | 500                                                                      |              |              |                 |
| 1492                          | 900                                                                      |              |              | UF <sub>6</sub> |
| 1520                          | 1000                                                                     |              |              | UF <sub>6</sub> |
| 1531                          | 500                                                                      |              |              | UF <sub>6</sub> |
| TOTAL                         | 3500                                                                     |              |              |                 |

\*Measured from the date of this Report.

**MARKET OPPORTUNITIES**

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

**URANIUM DEMAND**

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U <sub>3</sub> O <sub>8</sub> ) |              |              | Remarks   |
|-------------------------------|--------------------------------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                                              | 1 to 2 Years | 2 to 3 Years |           |
| Inquiries to Purchase:        |                                                                          |              |              |           |
| 1459                          |                                                                          | 200          | 200          | Long term |
| 1462                          |                                                                          |              | 100          | Long term |
| 1488                          |                                                                          | 100          |              |           |
| 1489                          | 200                                                                      |              |              |           |
| 1529                          |                                                                          |              | 550          | Long term |
| TOTALS                        | 200                                                                      | 300          | 850          |           |

**Inquiries to Borrow:**

|       |     |  |
|-------|-----|--|
| 1553  | 900 |  |
| TOTAL | 900 |  |

\*Measured from the date of this Report.



# MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the secondary market for UFe conversion services. The data presented in this section are in no way intended to be indicative of the entire market for the time period covered.

## CONVERSION SUPPLY

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U as UFe) |              |              | Remarks |
|-------------------------------|----------------------------------------------------|--------------|--------------|---------|
|                               | 0 to 1 Year                                        | 1 to 2 Years | 2 to 3 Years |         |
| 1394                          | 850                                                |              |              |         |
| 1450                          | 850                                                |              |              |         |
| 1451                          | 150                                                |              |              |         |
| 1475                          | 850                                                |              |              |         |
| 1533                          | 350                                                |              |              |         |
| 1540                          | 650                                                |              |              |         |
| TOTAL                         | 3700                                               |              |              |         |

## CONVERSION DEMAND

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U as UFe) |              |              | Remarks |
|-------------------------------|----------------------------------------------------|--------------|--------------|---------|
|                               | 0 to 1 Year                                        | 1 to 2 Years | 2 to 3 Years |         |
| 1488                          |                                                    | 100          |              |         |
| 1556                          | 850                                                |              |              |         |
| TOTALS                        | 850                                                | 100          |              |         |

\*Measured from the date of this Report.

INDEX

URANIUM MARKET INDEX

| Topic                                             | Report Number |     |     |     |     |     |      |     |     |     |     |     |  |
|---------------------------------------------------|---------------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|--|
|                                                   | 136           | 137 | 138 | 139 | 140 | 141 | 142  | 143 | 144 | 145 | 146 | 147 |  |
| Projected US & Free World Production              | 1.0           |     |     | 1.0 |     | 1.2 |      |     |     |     |     | 7   |  |
| Actual US & Free World Production                 |               |     | 1.5 |     |     | 1.5 |      |     | 5   |     |     | 12  |  |
| US Import-Export Balance                          |               |     |     |     |     |     | 6    | 1   |     |     |     | 11  |  |
| Apparent Future Consumption Estimate              |               |     | 1.1 |     |     |     | 2, 4 |     | 2   |     |     | 2   |  |
| USDOE Forecast of Uranium Requirements            |               |     |     |     |     |     |      |     | 7   |     |     |     |  |
| Uranium Supply & Demand Balance                   | 1.0           |     |     |     |     |     | 1    |     |     | 1   | 9   | 10  |  |
| Projection of Installed Nuclear Electric Capacity |               |     |     |     | 1.2 | 1.7 |      |     | 3   |     |     | 1   |  |
| Past Nuclear Electric Power Generation            |               |     |     | 1.1 |     |     |      |     |     |     |     | 14  |  |
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# NUEXCO

JANUARY 1981

NUMBER 149

## Monthly Report on the Uranium Market

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# NUEXCO

## MONTHLY REPORT ON THE URANIUM MARKET

January 1981

No. 149

JAMES E. VAUGHAN, *EDITOR*

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# NUEXCO

## FOREWORD

We are happy to announce that Teresa T. Elms has joined the Nuexco staff as an Associate. Terry came to Nuexco from Pan American World Airways where she was a Language Coordinator. Terry is a graduate of Stanford University where she majored in East Asian Studies.



## URANIUM MARKET

## GENERAL

In Report 147, Nuexco presented a forecast of Apparent Future Consumption, and discussed the assumptions underlying the forecast. Several subscribers questioned whether the rate of reduction in uranium requirements due to nuclear physics improvements was too fast, and whether the forecast improvements in fuel exposure were too aggressive.

Subscriber concern arose over an unclear statement in that Report: "More efficient fuel design is expected to lead to an overall reduction in uranium consumption of approximately 15 percent between 1981 and 1985 and another 15 percent between 1985 and 1990." What should have been said was that the INFCE<sup>1</sup> studies discuss improvements of 15 and 30 percent for LWR plants, but Nuexco used a much more conservative basis for physics improvements in the consumption forecast published in Report 147. A comparison between INFCE improvements and Nuexco assumptions is shown in Table 1.

More specifically, the INFCE report discusses nine methods for improving uranium utilization in LWR plants:

1. Increased burnup (MWD/MTU)
2. Lattice changes
3. Spectrum shift
4. Enrichment zoning, including blankets
5. Full use of early batches of startup core

6. Improved fuel management and control design
7. End-of-cycle coastdown
8. Reconstitution inversion of BWR fuel
9. Increased frequency of refueling

The INFCE report states that

*... some of these improvements are likely to be relatively easily demonstrated; others are expected to be more difficult and require additional time and resources. Each improvement category has been considered separately even though most of the improvements are interrelated, and therefore their contributions to a cumulative reduction in uranium requirements would not be additive ...*

*It is estimated that measures which could lead to savings of 10 to 15% in uranium utilization without undue economic or safety consequences could be demonstrated during the next decade, provided the necessary development programmes are successful.*

*In the course of further development, additional savings might be demonstrated; some countries estimated another 15% savings to be achievable, whereas others were less confident that such savings are possible.*

Nuexco recognized that these improvement targets had to be discounted in terms of general application to LWR plants. Thus Nuexco selected improvements in uranium utilization of 3.4 percent by 1985 and 9.7 percent by 1990, as shown in Table 1.

INFCE also noted that "one of the more attractive means of improving uranium utilization in the once-through mode would be to increase the discharge burnup." INFCE then discussed reductions in uranium requirements arising from increased fuel ex-

<sup>1</sup>International Nuclear Fuel Cycle Evaluation, International Atomic Energy Agency, Vienna, 1980; Volume 8, Advanced Fuel Cycle and Reactor Concepts, Report of INFCE Working Group 8, pages 53-67.

Table 1  
COMPARISON OF THIRTY YEAR URANIUM  
REQUIREMENTS (MTU/GWe) FOR PWR PLANTS  
OF CURRENT AND IMPROVED DESIGN BETWEEN INFCE<sup>1</sup> AND NUEXCO<sup>2</sup>

|                               | Current Design | Nuexco Assumption for<br>Plants Operating in: |       | INFCE Improved Design<br>Leading to<br>Uranium Savings of: |       |
|-------------------------------|----------------|-----------------------------------------------|-------|------------------------------------------------------------|-------|
|                               |                | 1985                                          | 1990  | 15%                                                        | 30%   |
| INFCE <sup>1</sup> (MTU/GWe)  | 4,350          |                                               |       | 3,700                                                      | 3,040 |
| Nuexco <sup>2</sup> (MTU/GWe) | 4,350          | 4,200                                         | 3,930 |                                                            |       |
| Relative Improvement (%)      | Base           | 3.4                                           | 9.7   | 15                                                         | 30    |

<sup>1</sup>Adapted from Table V (page 67) of INFCE Volume 8.

<sup>2</sup>Nuexco data normalized to INFCE conditions.



## URANIUM MARKET

posture ranging from 5 to 12 percent and presented tabular data on fuel cycle information for several of these cases. These cases, supported by further detail in the NASAP studies<sup>2</sup> of the same cases, provided Nuexco with consistent sets of physics data for modest improvements in uranium utilization. Thus, Nuexco's assumption of modest improvements in uranium utilization were achieved wholly by increasing fuel exposure and essentially discounted the other eight areas of fuel improvement potential.

A similar approach was followed for heavy water reactor plants where modest improvements in uranium utilization were assumed by 1985, but larger gains were instituted by 1990 through the use of slightly enriched uranium (1.20 percent U<sup>235</sup>) in reload fuel. For conservatism, no improvements were assumed for gas-cooled reactor plants.

### AUSTRALIA

After a decade of uncertainty and political and public debate, 1980 saw Australia emerge as a significant new force in the uranium production industry. Political and related problems were such that Australia was unable to enter the market when it was at its strongest. The necessity of marketing in a declining market was difficult and time consuming and resulted naturally in less favorable terms and conditions than could have been obtained earlier. Nevertheless, buyers were eager to have Australia in the market as a competitor to the other major exporting countries, and consequently were prepared to agree to terms they were unwilling to grant sellers in other countries. Major developments involving approved projects include:

1. Queensland Mines' Nabarlek facility was successfully commissioned in mid-year, and the initial export shipment occurred in November. Marketing is proceeding with some long-term contracts signed and others in various stages of negotiation.

2. The Ranger project made enormous strides. Peko Wallsend and Electrolytic Zinc arranged the repurchase of the government's 50 percent share of the project and the launching of a new corporate entity, Energy Resources of Australia (ERA) to own and

manage the project. Substantially all the production, rated at 6.6 million pounds U<sub>3</sub>O<sub>8</sub> annually, has been committed through 1996. Development of the mine and mill complex is on schedule, with production to begin in late 1981.

3. Western Mining's Yeelirrie project continued to move forward, with the completion of a pilot plant at Kalgoorlie to test the metallurgy circuits on a continuous basis. Production is anticipated in late 1985.

4. Mary Kathleen continued operations, at the rate of about 1.8 million pounds U<sub>3</sub>O<sub>8</sub> annually, and is investigating additional uranium investments because reserves at the current mine will be exhausted by the end of 1984.

The outlook for a number of other projects will depend on market developments in the coming years as well as the posture adopted by the Australian government as international competition increases.

1. Denison Mines of Canada purchased the Koon-garra deposit from Noranda, also a Canadian company, and is seeking the necessary approvals with a view towards beginning site development in 1981.

2. Pancontinental continued its efforts to gain aboriginal agreement and other approvals necessary to develop its enormous Jabiluka deposit.

Roxby Downs, Beverly, Honeymoon, Lake Way, and a number of other potential developments continued to move forward, but the timing of these projects remains market dependent.

### AFRICA

The Chairman of South Africa's Rand Mines Ltd. observed in his annual statement to shareholders that the two Rand Mines uranium producers, Harmony and Blyvooruitzicht, have sold most of their production under long term contracts, but that "any excess will be stockpiled awaiting the considerable improvement in prices that is expected in the years to come." His statement follows a similar announcement regarding stockpiling by Anglo American Corp., South Africa's largest uranium producer.

In the 1980 report to shareholders, the chairman of Anglo American's Orange Free State gold mining companies announced in connection with the Joint Metallurgical Scheme (JMS) that total JMS uranium profits fell from about R43 million in 1979 to about R18.5 million in 1980. The decrease was due primarily to the weakening spot market for uranium and

<sup>2</sup>Nuclear Proliferation and Civilian Nuclear Power: Report of the Nonproliferation Alternative System Assessment Program, Volume IX: Reactor and Fuel Cycle Descriptions, DOE, December 1979.

## URANIUM MARKET

the suspension of uranium deliveries to the Atomic Energy Organization of Iran.

### CANADA

Optimism for the long term continued for Canadian uranium producers during 1980 although a distinct near term slowdown was apparent. As in other countries the many facets of energy, its development and use are of primary concern in Canada. The recently published Canadian federal budget has focused attention on the energy issue because the federal government continues to impose price controls on Canadian oil producers in the western provinces, while subsidizing imported oil for the eastern provinces. The effect has been divisive, with the western provinces holding that the federal controls strike at the basic right of the provinces to control their own resources. Another effect of the federal budget is the slowdown of large western oil projects, which is expected in turn to have a negative impact on all sectors of the Canadian economy.

The cutback in western oil projects, combined with a mild summer and sharp drops in the Michigan and Ontario auto industries have resulted in lower than expected load growth for Ontario Hydro. This could lead to a stretchout in the construction schedule for Hydro's Darlington nuclear station. The four Darlington 850 MWe units are currently scheduled for startup in the 1989-1991 time frame.

At Elliot Lake, 1980 saw both Denison and Rio Algom continue their expansion programs, Denison toward an annual production goal of about six million pounds  $U_3O_8$  by 1985 and Rio to a goal of about eight million pounds  $U_3O_8$  per year by 1984.

In Saskatchewan, Amok started mining at Cluff Lake during the summer of 1980. Mill completion is expected in early 1981, and planned annual production is 4.4 million pounds  $U_3O_8$ . Eldorado continues to produce at Beaverlodge at an annual rate of one million pounds  $U_3O_8$ , and Gulf and Uranerz continue to operate Rabbit Lake and an annual rate of about five million pounds  $U_3O_8$ . Public hearings on the Key Lake project continued into the latter part of 1980. Production is anticipated by the Key Lake owners (Saskatchewan Mining Development Corp., Uranerz, and Eldorado) to begin in late 1983. The planned rate of production is at least eight million pounds  $U_3O_8$

annually, and could be increased to as much as 12 million pounds.

The government policy in Saskatchewan is stated to ensure that products from established mines are marketed prior to approval of further expansions by scheduling the rate at which new deposits are developed. The government has also developed royalties and taxes to maximize returns to the province.

### EUROPE

Nuclear power stations are "no more, and probably less" of a risk to the public than power stations burning coal or oil, says a report from the Health and Safety Executive (HSE) of England. The HSE reached this conclusion after examining the published scientific information on accidents and other associated dangers of the three basic systems for generating electricity. The HSE is primarily responsible for the health and safety of workers in England.

During the Swiss hydrological year of October 1979 through September 1980, the total share of electrical generation from nuclear power was 26.5 percent. This was an increase of about 18 percent over the previous year, and resulted from the startup of the Goesgen plant.

### FAR EAST

The Japanese government recently adopted an official target for non-oil energy supplies, designed to reduce reliance on imported oil from the present 73 percent to 50 percent by 1990. As a part of this plan, it is intended that nuclear generating capacity will be increased from the current 15,000 MWe to between 51,000 and 53,000 MWe by 1990.

Japan currently has 21 nuclear power plants on line. To achieve the 1990 goal will require an increase to 55 to 60 plants. Of the 34 to 39 new plants required seven units representing 5,700 MWe are currently under construction with start-ups scheduled between early 1981 and late 1984. Six additional units, representing 5,900 MWe, have passed the necessary safety and licensing reviews by the cognizant regulatory agencies. These plants are scheduled for start-up in the 1985-1986 period. In addition, preliminary engineering and licensing work has been initiated on six other units, representing nearly 6,000 MWe, for

## URANIUM MARKET

completion later in the 1980's.

To achieve its goal, the Japanese will have to bring on line an average of almost four plants annually during this decade. While not impossible, based on a past history of siting and licensing difficulties, this target must be viewed as very optimistic.

### UNITED STATES

The Reagan Administration will be faced with many serious problems in its effort to expand nuclear electrical supply capabilities. Utilities are in need of favorable regulatory actions and rate structures, and steps need to be taken to reduce the licensing time for nuclear power plants. These issues are discussed in detail in the *Commentary* section of this Report.

Atlas Minerals Corp. has recently begun mining its newest producer, the Velvet Mine, located about 50 miles southeast of the Atlas Mill near Moab, Utah. Access to the orebody is through a 3,400 foot long

decline. Most of the development of the ore body is complete. The ore body is expected to average over 15 pounds  $U_3O_8$  per ton of ore, and contains an estimated six million pounds  $U_3O_8$ . It is one of the highest grade deposits to be found in the US in recent years.

The Atlas mill is shown in Figure 1. It is licensed to operate at 1,600 tons ore per day, and consists of two circuits, an acid-leach circuit which recovers uranium and vanadium, and an alkaline-leach circuit which can recover uranium and copper. Design uranium recovery capacity is about 1.8 million pounds  $U_3O_8$  annually, but recent production has been well below this.

A number of US utilities have recently found themselves unable to raise capital in both the equity and debt markets. Several utilities withdrew bond offerings during the past month because of high interest rates, inability to secure long maturity periods, or lack of interest among investors. Similar



Figure 1  
AERIAL VIEW OF THE ATLAS MINERALS MILL, MOAB, UTAH

## URANIUM MARKET

conditions have been experienced by US utilities seeking to sell new equity. The recent disarray in the securities markets may add to the financial problems faced by many US utilities. Such conditions, if long continued, could result in the further slippage of nuclear power projects due to money shortages.

### TRANSACTIONS

There were two transactions reported this month. Both of them involve short term sales from US producers to US producers; one for between 301,000 and 600,000 pounds U<sub>3</sub>O<sub>8</sub>, and one for less than 50,000 pounds. The smaller quantity was delivered in December, while deliveries on the larger quantity will extend into 1981.

### PRICING

The Exchange Value dropped this month to \$27.00 from \$28.00 last month. As periodically happens, a spread of two to three dollars per pound between bid and offer price levels has developed with little evidence of compromise on either side. As a result, few transactions have taken place.

It has been customary in years past to see some activity by sellers in December to book sales for the ending calendar year; there was no indication this year that that was a factor. Perhaps it was because the last minute discretionary production that might normally be available was not produced at all due to the low spot market price.

It is nevertheless clear that prices are significantly softer than they were the previous month. The transactions that did take place were at lower prices than the previous month's Exchange Value. Offers to sell have also declined somewhat. However, the limited interest in purchasing was in the \$25 per pound range. Material in significant quantities could not be purchased at that level as of the end of December since sellers were not willing to reduce prices that much.

The total of active inquiries to sell in 1981, listed in the Market Opportunities section of this Report is about 7.5 million pounds U<sub>3</sub>O<sub>8</sub> equivalent, while the total of active inquiries to purchase is only 200,000 pounds. Of the total available for sale in 1981, approximately seventy percent involves inventory sellers. The influence of inventory sellers continues to put downward pressure on the market. Additional downward pressure can be expected just as a result of the very large imbalance of supply vs. demand.

### CONVERSION

The amount of conversion services available on the secondary market decreased to about 1.6 million pounds U in UF<sub>6</sub>. Several offers were withdrawn, some because the sellers were involved in conversion transactions which either closed or are near closing. In two of these transactions, UF<sub>6</sub> inventory holders are deconverting their material in order to respond to inquiries to purchase U<sub>3</sub>O<sub>8</sub>.

Based on transactions that have closed recently, or are in negotiation, and current bids and offers, it now appears that spot conversion transactions on the secondary market could be completed in the near term at a price of about \$1.00 per pound U as UF<sub>6</sub>.

Deconversion transactions, or secondary conversion sales, are simply swaps of uranium concentrates for UF<sub>6</sub>. They are very simple transactions provided that the concentrates have been accepted for conversion and can be book transferred at a conversion facility. This requires that both parties involved have a clear understanding of their rights to transfer title to their material (either concentrates or UF<sub>6</sub>). The deconversion transaction may soon become standard industry practice both to obtain spot conversion on the secondary market, and to serve as a process by which utilities and others holding inventory in the form of UF<sub>6</sub> can reach a market seeking to buy uranium in the form of concentrates.



# TOPICAL ESSAY

## WORLD CAPTIVE URANIUM PRODUCTION

A significant portion of the world's uranium production is captive to users. The term "captive" is described in more detail below. In essence, the term refers to material which is not now and is not likely to become available for sale in the commercial uranium market. The existence of this captive production will have an important impact on the uranium market throughout the coming decade.

Table 2, entitled US Uranium Production Forecast: Captive vs. Commercial, segregates Nuexco's forecast of US uranium production into its captive and commercial components. As of 1980, captive production represents approximately 16 percent of the total US production. The proportion of US U<sub>3</sub>O<sub>8</sub> production which is captive drops off to 9 percent of the total by 1990.

Table 3 shows the same breakdown for the balance of the Free World. In contrast to the United States, non-US captive production exceeds the commercial production in each year of the period.

Care should be taken in interpreting these data. Ideally, a precise definition of "captive" would make it easy to distinguish production of this type from commercial production. However, in reality, no two captive production relationships are identical, and there are many borderline cases. Consequently, in generating these data each production center was considered individually; specific judgments were made as to whether a given production center should be categorized as captive or commercial.

This somewhat ambiguous definition of captive production flows from the varied ways users have secured captive production. For example, one method of tying up production is direct ownership in which the utility actually owns the firm producing the

material. An example is Commonwealth Edison's ownership of the Cotter Corporation.

Another form of captive production is equity participation in which a utility will purchase a portion of the producing property with the right to some or all of its material. Southern California Edison's relationship with Rocky Mountain Energy in the Bear Creek venture is such an arrangement.

Yet another form of captive production is one in which the utility advances money for development of a property in exchange for the right of first refusal on some or all material produced from the property, over and above the basic contract quantities. The Long Island Lighting Company relationship with Bokum Resources is such an arrangement. This form of captive production demonstrates the fine line between captive and commercial production since it is not much different from a commercial operation which has committed the bulk of its production to a single user in a contract that has prepayment terms.

A general test which was used to evaluate various production operations was to evaluate what would happen if an additional quantity of material were to be produced. If any material produced above the expected quantity were allocated to the buyer or if the buyer had the first right of refusal, then the production may be deemed to be captive.

Table 4 shows Nuexco's current forecast of total Apparent Future Consumption. Some of the consumption included in the totals of Table 4 can be offset by captive production to yield a commercial Apparent Future Consumption figure, but it is a fundamental premise of this analysis that the offset should be made for *individual users* only. For example, if a Swiss utility were to have captive production of one million pounds in 1983, and total consumption of two million pounds, to compute

Table 2  
US URANIUM PRODUCTION FORECAST  
CAPTIVE vs. COMMERCIAL  
(millions of pounds U<sub>3</sub>O<sub>8</sub>)

|                       | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|-----------------------|------|------|------|------|------|------|------|------|------|------|------|
| Captive Production    | 5.5  | 5.8  | 4.5  | 4.1  | 3.3  | 3.2  | 2.7  | 2.4  | 2.4  | 1.9  | 1.4  |
| Commercial Production | 28.7 | 23.2 | 22.4 | 22.0 | 20.7 | 17.9 | 16.8 | 16.0 | 14.4 | 14.4 | 14.4 |
| TOTAL <sup>1</sup>    | 34.2 | 29.0 | 26.9 | 26.1 | 24.0 | 21.1 | 19.5 | 18.4 | 16.8 | 16.3 | 15.8 |

<sup>1</sup>Reference Report 147, Table 7.

## TOPICAL ESSAY

Table 3  
URANIUM PRODUCTION FORECAST: WOCA OUTSIDE US  
CAPTIVE vs. COMMERCIAL  
(millions of pounds U<sub>3</sub>O<sub>8</sub>)

|                          | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987  | 1988  | 1989  | 1990 |
|--------------------------|------|------|------|------|------|------|------|-------|-------|-------|------|
| COMMERCIAL               |      |      |      |      |      |      |      |       |       |       |      |
| Australia                | 2.8  | 4.8  | 4.8  | 4.8  | 4.8  | 6.0  | 9.0  | 9.0   | 9.0   | 9.0   | 6.0  |
| Canada                   | 13.3 | 10.1 | 11.6 | 11.4 | 13.2 | 14.0 | 16.0 | 18.0  | 18.4  | 18.4  | 18.4 |
| Republic of South Africa | 13.7 | 17.1 | 18.0 | 18.6 | 19.1 | 19.1 | 19.1 | 18.9  | 18.9  | 18.8  | 18.8 |
| TOTAL COMMERCIAL         | 29.8 | 32.3 | 34.4 | 34.8 | 37.1 | 39.1 | 44.1 | 45.9  | 46.3  | 46.2  | 43.2 |
| CAPTIVE                  |      |      |      |      |      |      |      |       |       |       |      |
| Australia                | -0-  | 1.0  | 6.0  | 6.0  | 6.0  | 6.0  | 6.0  | 6.0   | 6.0   | 6.0   | 6.0  |
| Canada                   | 4.7  | 6.0  | 8.0  | 8.0  | 9.0  | 9.0  | 9.0  | 9.0   | 9.0   | 9.0   | 9.0  |
| Central Africa           | 13.1 | 15.3 | 15.3 | 15.3 | 15.3 | 15.3 | 15.3 | 15.3  | 15.3  | 15.3  | 15.3 |
| France                   | 5.4  | 7.4  | 7.7  | 7.8  | 8.3  | 8.3  | 8.3  | 8.3   | 8.3   | 8.3   | 8.3  |
| Namibia                  | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0  | 10.0  | 10.0  | 10.0 |
| Republic of South Africa | 1.7  | 1.8  | 1.8  | 1.8  | 1.8  | 2.2  | 2.6  | 2.6   | 2.6   | 2.6   | 2.6  |
| Other Nations            | 1.3  | 1.4  | 1.5  | 2.5  | 2.7  | 3.2  | 3.2  | 3.2   | 3.2   | 3.2   | 3.2  |
| TOTAL CAPTIVE            | 36.2 | 42.9 | 50.3 | 51.4 | 53.1 | 54.0 | 54.4 | 54.4  | 54.4  | 54.4  | 54.7 |
| TOTAL <sup>1</sup>       | 66.0 | 75.2 | 84.7 | 86.2 | 90.2 | 93.1 | 98.5 | 100.3 | 100.7 | 100.6 | 97.9 |

<sup>1</sup>Reference Report 117, Table 8.

Table 4  
APPARENT FUTURE CONSUMPTION<sup>1</sup>  
(millions of pounds U<sub>3</sub>O<sub>8</sub>)

|                               | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| BUYER GROUP                   |      |      |      |      |      |      |      |      |      |      |      |
| United States                 | 16.7 | 20.9 | 22.9 | 27.1 | 30.4 | 32.8 | 35.5 | 35.1 | 37.6 | 40.4 | 40.3 |
| Europe                        | 17.2 | 25.6 | 28.9 | 35.4 | 30.8 | 36.3 | 38.0 | 44.9 | 42.4 | 43.3 | 42.7 |
| Far East <sup>2</sup>         | 3.8  | 6.9  | 6.9  | 6.8  | 11.1 | 11.7 | 11.6 | 10.7 | 9.6  | 8.5  | 8.7  |
| Other Free World <sup>3</sup> | 2.7  | 3.1  | 5.1  | 5.9  | 5.1  | 4.6  | 5.9  | 7.5  | 7.2  | 5.6  | 6.1  |
| FREE WORLD <sup>3</sup> TOTAL | 40.4 | 56.5 | 63.8 | 75.2 | 77.4 | 85.4 | 91.0 | 98.2 | 96.8 | 97.8 | 97.8 |

<sup>1</sup>Computed quantities of U<sub>3</sub>O<sub>8</sub> which would be used under the given conditions, to fabricate fuel for loading and reloading reactors operating, under construction or on order as of October 31, 1980. Compiled and computed on a reactor-by-reactor basis, quantities for each reactor are based on specific core characteristics, 0.25% tails assay, no recycling, 24-month lead time for procuring first cores and 18-month lead time for procuring each reload. Where reload schedule is not already known, these estimates assume reloads occur one year after commercial operating date and annually thereafter. Nuexco estimates of individual reactor capacity factors are used.

<sup>2</sup>Japan, Korea, People's Republic of China, Taiwan.

<sup>3</sup>Excludes Bulgaria, Czechoslovakia, German Democratic Republic, Finland (two Russian Reactors), Hungary, Poland, Romania, USSR.

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*commercial* Apparent Future Consumption for Europe in 1983, it would be necessary to reduce total Apparent Future Consumption by one million pounds, as a result of the Swiss utility's having that amount covered by captive sources. If another Swiss utility had captive production of two million pounds and consumption of only 500,000 pounds in 1983, Europe's Apparent Future Consumption would as a result be reduced by only 500,000 pounds in 1983 to yield *commercial* Apparent Future Consumption. In the second example, however, the excess of 1.5 million pounds would be carried forward and would be available to offset future consumption *for that utility only*. When Apparent Future Consumption for each utility has been reduced (as described above) by that utility's captive production, the result is that utility's *commercial* Apparent Future Consumption. The sum of those estimates is shown in Table 5, in which the individual utilities are grouped according to Nuexco's customary format.

A comparison of Table 4 and Table 5 shows that a significant portion of the Apparent Future Consumption in the coming decade has already been accounted for by captive production. The net impact of this is that there is an even smaller portion of demand available for those commercially oriented uranium producers. Moreover, the captive producers are generally not the lowest cost producers. Thus, the portion of demand consumed by captive production does not remove many low cost producers from commercial activities.

Table 6 analyzes the balance of uranium supply and demand which results from the commercial production and commercial consumption developed

in Tables 2, 3 and 5. Inventory, in this context, refers to uranium which is or could become available for sale on the worldwide market as a result of economic factors, as opposed to considerations of national policy. For example, inventory held by Japanese users is categorized as non-commercial due to Nuexco's belief that economic motivations would be insufficient, absent a change in national policy, to induce Japanese utilities to sell their uranium inventory. On the other hand, all inventory held by US utilities is deemed to be commercial. One ruling by the Federal Energy Regulatory Commission (FERC) which might change FERC's guidelines with respect to utility accounting treatment of uranium inventory could be sufficient to cause millions of pounds of uranium inventory to flood the market. No change in US national policy would be needed.

Table 6 shows that commercial production exceeds commercial consumption during each of the next nine years. However, the excess diminishes steadily from approximately 22 million pounds in 1981 to an insignificant amount by 1987. If all of the forecast excess is absorbed into inventory, the commercial uranium inventory would increase from 250 million pounds in 1981 to 335 million pounds in 1987. Commercial consumption increases more rapidly than inventory during the same period, so relative inventory level declines from almost nine years in 1980 to 7.5 years in 1981 to a slightly declining level of approximately six years by 1985. This trend suggests that commercial producers and consumers are adjusting to expectations of a weak uranium market more rapidly than captive producers and their consumers.



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Table 5  
APPARENT FUTURE CONSUMPTION  
AS REDUCED BY CAPTIVE PRODUCTION  
(millions of pounds U<sub>3</sub>O<sub>8</sub>)

|                                      | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|--------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Europe                               | 8.3  | 12.7 | 10.3 | 13.3 | 10.2 | 18.0 | 17.3 | 21.6 | 18.7 | 18.0 | 18.2 |
| Far East                             | 0.2  | 0.9  | 2.2  | 1.1  | 3.3  | 3.1  | 3.3  | 3.5  | 3.7  | 2.9  | 2.6  |
| Other Nations<br>(Other non-US WOCA) | 2.4  | 2.7  | 3.5  | 3.3  | 2.3  | 0.9  | 0.9  | 2.1  | 2.9  | 1.2  | 1.9  |
| Subtotal (non-US WOCA)               | 10.9 | 16.3 | 16.0 | 17.7 | 15.8 | 22.0 | 21.5 | 27.2 | 25.3 | 22.1 | 22.7 |
| US                                   | 13.4 | 17.3 | 20.6 | 21.3 | 28.1 | 29.8 | 33.2 | 31.1 | 35.2 | 37.5 | 37.4 |
| TOTAL (WOCA)                         | 24.3 | 33.6 | 36.0 | 42.0 | 43.9 | 51.8 | 54.7 | 58.3 | 60.5 | 59.6 | 60.1 |

Table 6  
COMMERCIAL URANIUM SUPPLY-DEMAND BALANCE: WOCA<sup>1</sup>  
(millions of pounds U<sub>3</sub>O<sub>8</sub>)

|                                      | 1980               | 1981  | 1982  | 1983  | 1984  | 1985  | 1986  | 1987  | 1988  | 1989  | 1990  |
|--------------------------------------|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Commercial Production <sup>2</sup>   | 58.5               | 55.5  | 56.8  | 56.8  | 57.8  | 57.0  | 60.9  | 61.9  | 60.7  | 60.6  | 57.6  |
| less                                 |                    |       |       |       |       |       |       |       |       |       |       |
| Commercial Consumption <sup>3</sup>  | 24.3               | 33.6  | 36.0  | 42.0  | 43.9  | 51.8  | 54.7  | 58.3  | 60.5  | 59.6  | 60.1  |
| equals                               |                    |       |       |       |       |       |       |       |       |       |       |
| Net Inventory Increase<br>(Decrease) | 34.2               | 21.9  | 20.8  | 14.8  | 13.9  | 5.2   | 6.2   | 3.6   | 0.2   | 1.0   | (2.5) |
| plus                                 |                    |       |       |       |       |       |       |       |       |       |       |
| Beginning Inventory                  | 216.1 <sup>4</sup> | 250.3 | 272.2 | 293.0 | 307.8 | 321.7 | 326.9 | 333.1 | 336.7 | 336.9 | 337.9 |
| equals                               |                    |       |       |       |       |       |       |       |       |       |       |
| Ending Inventory                     | 250.3              | 272.2 | 293.0 | 307.8 | 321.7 | 326.9 | 333.1 | 336.7 | 336.9 | 337.9 | 335.4 |
| Relative Inventory <sup>5</sup>      | 8.9                | 7.4   | 7.6   | 7.0   | 7.0   | 6.2   | 6.0   | 5.7   | 5.6   | 5.7   | 5.6   |

<sup>1</sup>World outside Communist areas.<sup>2</sup>This Report, Tables 2, 3.<sup>3</sup>This Report, Table 5.<sup>4</sup>Nuexco estimate.<sup>5</sup>For each year, Relative Inventory equals Beginning Inventory divided by Consumption.

COMMENTARY

**THE HALBOUTY REPORT**

The future of US energy policy under the new administration was given direction recently in a report by President-elect Reagan's group of energy advisors headed by Michael Halbouty.

With a call for "undoing the restrictive legislation of the past four years," the November report includes reforms and reviews on a wide range of topics ranging from oil, natural gas, nuclear power to the Department of Energy itself. The main emphasis is on creating "an open and competitive energy market that will meet the demands of our economy and the needs of our society." The move is away from government imposed controls and excessive regulations to a free market where consumers reap the rewards of competitive energy pricing and where the US gains political and economical stability by decreasing dependence on foreign oil.

The specifics of the policy presented include the decontrol of oil and gas, the opening of public lands for exploration and development, the use of scientific cost-benefit factors as a basis for environmental policy, the encouragement of research and development of new energy technologies, the building of a significant emergency petroleum reserve and a worldwide push for energy production.

To alleviate the national security problem stemming from US dependence on foreign oil, Halbouty and associates see coal taking a lead along with nuclear power. However, the severe regulatory restrictions, such as those on air quality, are choking the possibilities and the report calls for their removal.

As with coal, the report recognizes the detrimental impact of excessive regulation on the future of nuclear power, while citing its crucial role in national security and future economic growth. It charges the Carter Administration with a policy of "benign neglect" toward nuclear power resulting in a web of details crippling the US Nuclear Regulatory Commission and hampering the licensing procedures of nuclear plants in particular. Simplification of these procedures is "absolutely essential" and would emphasize the important safety matters presently tangled in the whole process while assuring implementation of the lessons learned from Three Mile Island.

The report also attacks the non-proliferation policies of the Carter Administration as "counter productive" and damaging to the domestic and

export nuclear program. An important first step in the Reagan presidency would be a review of these policies.

Expedient action by state regulatory agencies is deemed critical for the financial future of utilities. The report recommends the inclusion of in-progress construction costs in the rate base, satisfactory rate structures and the retention of benefits of accelerated depreciation and investment tax credits. Speedy legislation would be implemented to coordinate and expedite decisions on major energy projects while respecting state and local rights.

To attain the desired closing of the nuclear fuel cycle, the "Halbouty policy" calls for rapid construction of away-from-reactor spent fuel storage facilities, as well as streamlining of procedures for fuel storage facilities and fuel reprocessing plants.

This outline for a Republican energy policy presents a commitment to the nuclear industry. Stating that "electrical energy generated with our vast indigenous coal and uranium resources can make a major contribution to reducing the national security threat created by our dependence on imported petroleum," the continuing role of nuclear power is seen as essential to US political and economic stability. The recommendations from Reagan's energy advisors provide the basis for strengthening this role.

**The text of the Halbouty Report concerning Nuclear and Electric Power is reproduced below in its entirety.**

An expanding and healthy economy requires increasing electric supply capability. In addition, obsolete oil and gas fired capacity will need to be replaced. Only coal and nuclear plants can fill this need and they are highly capital intensive.

The most serious problem the utility industry faces is achieving favorable action by state regulatory agencies including inclusion of the cost of construction work in progress in the rate base, the retention by the utilities of the intended benefits of accelerated depreciation and investment tax credits, as well as satisfactory rate structures.

Revitalization of the essential nuclear power program requires top-level national leadership which itself can substantially strengthen public support and facilitate necessary legislative changes.

The Carter Administration's policy of benign neglect toward nuclear power has left the Nuclear

## COMMENTARY

Regulatory Commission (NRC) adrift without support or guidance from the White House. This situation has contributed directly to the current nuclear plant licensing quagmire. It currently takes up to twelve to fifteen years to license and construct a nuclear power plant. It is absolutely essential that NRC licensing procedures be streamlined to reduce the time between the application for a construction permit and commercial operation. Expediting the licensing process would force all regulators to separate the important from the unimportant and thus direct sufficient attention to safety matters which have currently become smothered in a morass of detail. In this process, the government must take all steps necessary to assure that the lessons learned from Three Mile Island have been implemented and that public health and safety continues to be the primary concern. Reducing the licensing time for nuclear power plants by focusing on substantive issues only will enhance safety—not compromise it—and speed the time of United States energy security.

In addition to nuclear plant licensing, licensing requirements are currently being developed for facilities important to the balance of the nuclear fuel cycle, such as away-from-reactor spent fuel storage facilities and commercial radioactive waste repositories. Licensing procedures for these facilities as well as spent fuel reprocessing plants must be equally expeditious.

To the current time, the federal government's nuclear waste disposal program has been characterized by sudden and arbitrary changes in direction, emphasis and objectives and an unwillingness to fund and begin an adequate demonstration program. The result has been the mistaken perception by the general public that technologically feasible solutions

to the waste disposal issue are not within our grasp. The fact is that the difficulty has been political and institutional rather than technical. Several technologically sound waste disposal techniques are available for utilization now. To accommodate the transition period between now and the time when the nuclear fuel cycle is closed, we need rapid construction of away-from-reactor spent fuel storage facilities.

Effective policies with respect to proliferation of nuclear weapons are essential. Those of the Carter Administration have not only been counterproductive by increasing the risk but also have seriously damaged the United States' domestic and export nuclear program. An immediate review of these policies needs to be carried out especially as they affect international cooperation and institutions as well as the domestic program including nuclear fuel reprocessing and development of the breeder reactor.

Federal "fast-track" legislation is needed that avoids infringement on substantive state and local prerogatives, yet provides an effective mechanism for coordinating and expediting decisions on high priority major energy projects, including specifically coal-fired and nuclear power plants. Such legislation will also provide for expeditious judicial review of such decisions so that we, as a nation, can be about the business of building the energy security we desperately need.

We believe that electrical energy generated with our vast indigenous coal and uranium resources can make a major contribution to reducing the national security threat created by our dependence on imported petroleum and ensure that an adequate reserve of electrical energy is available to support future United States economic growth.

## RAW MATERIALS

### URANIUM IN ALKALINE ROCKS

#### Introduction

Alkaline igneous rocks are considered a favorable source of economic uranium deposits. Important reserves have been discovered in Greenland, Brazil, the USSR and the United States. However, mining of uranium ores in alkaline rocks has been limited primarily to the Bokan Mountain deposit located in southern Alaska. A small amount of uranium has been recovered as a by-product during the mining of other minerals from alkaline rocks in Brazil and South Africa.

Alkaline rocks are scattered throughout the major intrusive belts of the world. However, there are only about 28 known locations world-wide where rock characteristics have been determined as favorable for uranium deposits. Eleven principal locations are in the United States; the remaining 17 are scattered, primarily throughout Europe and Africa. Figure 2 shows the 28 locations of favorable alkaline and related igneous rocks world-wide.

Alkaline igneous rocks form a complex series of intrusives associated with granitic rocks. Alkaline intrusives are characterized as feldspathoid-rich rocks containing abundant rock-forming minerals of aluminum, sodium and potassium in a quartz-poor environment. The mineral-mix may occur in almost any ratio as  $\text{KNaAlSi}_3\text{O}_8$ . Actually, three different rock-types represent a favorable host for uranium. The most favorable alkaline rocks include the varieties rich in sodium and potassium with little aluminum oxide. They are referred to as peralkaline rocks. If the rock contains little or no quartz, it is classified as nepheline syenite. As the quartz content increases, a syenite grades into a less favorable granite. In any case, the rock is characterized by a higher-than-normal content of rare elements including zirconium, niobium, rare earths and uranium. The favorable localities for uranium in this rock-type are Ilimaussaq, Greenland and Pocos de Caldas, Brazil.

The second rock-type is peralkaline granites which form a group of oversaturated alkaline rocks high in iron content but deficient in aluminum oxide. The quartz content may be as high as 40 percent. The rock contains abundant dark, rock-forming silicate minerals of the pyroxene group. Rock containing anomalous quantities of uranium and other rare elements will usually contain less than 30 percent quartz. The

uranium deposit at Bokan Mountain, Alaska occurs in peralkaline granite.

The third favorable alkaline rock is classified as a carbonatite, a carbonate-rich intrusive closely associated with alkaline rocks. Carbonatites may occur in a zonal arrangement with other alkaline rocks, or forming ring dikes and breccia zones within caldera-like structures. The carbonatites are characterized by high phosphate content and abundant rare elements consisting predominantly of rare earths, uranium and thorium. Uranium is recovered as a by-product to copper mining of a carbonatite complex at Palabora in South Africa.

The concentration of uranium in igneous rocks varies greatly by rock type. The average uranium content will vary from about 0.003 to 5 parts per million (ppm). However, igneous rocks with 6 to 20 ppm uranium are common. Higher amounts are generally uncommon except where differentiation of rock-forming constituents shows concentration as in certain granites, pegmatites and alkaline rocks.

Uranium mineralization in the granite at Rossing, Namibia grades up to 1000 ppm uranium. The granites near Johan Beetz, Quebec contain local concentrations, or pods, that average about 70 ppm uranium. At Bokan Mountain, the peralkaline granite contains 20 to 200 ppm uranium with localized concentrations above 10,000 ppm, or 1 percent  $\text{U}_2\text{O}_5$  occurring in veins and fractures.

The concentration of uranium in alkaline rocks is generally higher than in other igneous rocks, a situation due to the unusually high content of rock-forming elements. The nepheline syenite series of Greenland, Brazil and Russia contain anomalous uranium—from 62 ppm at the Ilimaussaq occurrence in Greenland, to 2,000 ppm at Pocos de Caldas in Brazil. The economic favorability of such occurrences may be dependent upon the concentration of important minerals in addition to uranium, such as molybdenum, iron, zirconium and rare earths. The occurrence of high-grade uranium at Bokan Mountain is peculiar to that deposit; otherwise, high-grade ore is limited to isolated pods containing only a small tonnage of minable material.

#### Uranium Occurrences

Of the 28 locations where favorable alkaline rocks are known, only about six have been evaluated for the economic potential of uranium. The occurrence of

## RAW MATERIALS



Figure 2  
LOCATION OF POTENTIAL URANIUM-BEARING ALKALINE, PERALKALINE AND  
CARBONATITE INTRUSIONS, WORLD-WIDE THE NAMED OCCURENCES ARE DESCRIBED  
IN THE TEXT.

anomalous uranium has been noted in each case. Four of the locations are described according to the important characteristics for each rock-type and mineral association.

*Ilimaussaq, Greenland* The Ilimaussaq igneous complex of southwest Greenland is the host of a number of radioactive anomalies occurring in peralkaline nepheline syenites. The Geological Survey of Greenland has spent about 10 years evaluating the more promising areas of which the Kvanefjeld district is perhaps the most important of at least five major mineralized districts. The evaluation program is still in progress; however, the survey has announced the discovery of approximately 32,000 tonnes  $U_3O_8$  contained in 30 million tonnes ore. The uranium

mineralization is disseminated throughout the rock in concentrations from 0.01 to 0.30 percent  $U_3O_8$ ; the average content is 0.03 percent  $U_3O_8$ .

The peralkaline intrusives are included in the upper portion of the Gardar Formation which consists of a number of interbedded intrusive flows, dikes and basaltic lavas. The complete sequence occupies a large fault graben in Precambrian granite. The age of the Gardar is considered to be Precambrian also, dating from 1,500 to 1,000 million years ago. The important alkaline rocks are among the youngest in the formation at 1,040 to 1,000 million years of age.

Important uranium mineralization is concentrated in the coarse-grained fraction of stratified nepheline syenites, usually associated with segregated black and



## RAW MATERIALS

green rock-forming minerals. Such rocks are classified as lujavrites. The black rocks, especially along thin recrystallized zones and in structurally favorable areas (fractures and breccia zones) show the greatest concentration of uranium. The intrusion of the lujavrites has paralleled the main structural trends within the basement granites and a dominant north-west-southeast-trending fracture pattern that developed in the volcanic flows above the lujavrites. Exploration is directed toward such structural features.

The uranium mineral present is steenstrupine, a phosphate and silicate of rare earths containing niobium, tantalum, thorium and uranium. The uranium content of the rock shows evidence of enrichment in zones of alteration. Steenstrupine is considered to be both a primary and secondary mineral under this circumstance. Monazite is a secondary mineral of little economic importance.

*Pocos de Caldas, Brazil* Uranium mineralization occurs in a host of peralkaline rocks on the Pocos de Caldas Plateau located in the extreme southwestern part of the State of Minas Gerais. The plateau is a structural dome covering about 700 square miles. It was created during Upper Cretaceous time by intrusions of nepheline syenites (referred to locally as foyaites) into gneisses and granites of Precambrian age and sediments of Mesozoic age.

Uranium occurs in two forms at Pocos de Caldas. The more common occurrence is in association with zirconium in the mineral caldasite which is a mixed mineral of zircon ( $ZrSiO_4$ ) and baddeleyite ( $ZrO_2$ ). Caldasite is the principal ore mineral mined as a source of zirconium. It has not been an important source of uranium in the past due primarily to unfavorable economics of producing by-product uranium.

Disseminations of uranium occur throughout the caldasite, probably as a substitute for zirconium in the zircon lattice. Rock alteration has been intense in certain localities and in one altered zone, the secondary uranium mineral meta-autunite has been identified. Hydrothermal mineralization consisting of zircon, iron, molybdenum and uranium, is commonly associated with brecciated zones in coarse-grained foyaites.

Important uraniferous zirconium ores occur in at least four different environments. *Placer deposits* are favored for mining because the caldasite has been concentrated to 60-80 percent  $ZrO_2$ ; *eluvial deposits*

formed as a thin surface mantle (average thickness of about two feet) covering hill slopes offers easy mining but limited tonnage; *vein deposits* are scattered throughout the plateau area, but have been mined on a limited basis only because of lower grade ore and unfavorable economics; *disseminated deposits* show local concentrations of caldasite in decomposed rock, but is considered uneconomic for zirconium mining. Only a small amount of by-product uranium has been recovered during the mining of placer deposits where the uranium concentration had been naturally upgraded to about 0.50 percent  $U_3O_8$ .

Important uranium-molybdenum deposits are known in the Agostinho and Cercado districts of the central plateau area. At Agostinho, amorphous uranium mineralization is disseminated along the contact zones of fine to coarse-grained foyaites. Minor amounts of coffinite and uranotorite have been identified as associated minerals with zirconium, pyrite, fluorite and molybdenum.

The uranium content of the deposit varies from a trace to one percent or more  $U_3O_8$ ; the average is 0.02 percent  $U_3O_8$ . The uranium mineralization is closely associated with the pyrite and fluorite in altered breccia. The source of all mineralization is assumed to be associated with hydrothermal activity. The uranium was probably introduced simultaneously with the pyrite. In areas of intense alteration, the ratio of most minerals has been upgraded, especially the zirconium uranium ratio.

Five important ore deposits have been discovered in the Cercado district. The deposits occur in breccia zones separated by narrow bands of barren rock. Three deposits will be mined from one large open pit. The ore is to be processed in a nearby mill designed to produce 450 to 550 tonnes  $U_3O_8$  per year.

The mineral suite at Cercado is similar to Agostinho, but generally includes different associations due to intense weathering and alteration. Uranium mineralization occurs with caldasite, as pitchblende nodules common to alteration fronts associated with fluorite, zirconium and molybdenum, and in oxidized ores as coffinite and uranotorite.

The uranium reserves of the Agostinho and Cercado deposits have not been listed separately. However reserves of the Pocos de Caldas region have been estimated by Nuclebras at about 20,000 tonnes  $U_3O_8$ . The close proximity and similarity of ores at the Agostinho deposit suggests that all ore from Agostinho will be processed at the Cercado mill which



## RAW MATERIALS

should be in operation during 1981.

**Bokan Mountain, Alaska** The Bokan Mountain uranium deposit located on the southern tip of Prince of Wales Island at the south end of the Alaskan panhandle, was discovered by prospectors in 1955. Development began in 1957 and about 500,000 pounds  $U_3O_8$  were mined from a multi-vein system by open pit methods. Several years later, approximately one million pounds of high-grade ore was mined by underground methods from a downward extension of the mineralized zone. Subsequent exploration drilling of the ore trend from surface and underground stations resulted in the addition to ore reserves of one million to 1.3 million pounds  $U_3O_8$ , most of which may be accessible from existing underground workings.

The Bokan Mountain deposit has been the most productive to date from alkaline rocks; the present reserve situation suggests that it is one of the more important known occurrences in an alkaline environment. It also indicates the importance of post-Precambrian-aged granites as a potential source of uranium.

Bokan Mountain is a peralkaline syenite and granite stock of Jurassic age (190 to 170 million years old) introduced into massive quartz monzonite and grandiorites of Ordovician age (450 to 430 million years old). Pre-Ordovician metasediments and meta-volcanics were further metamorphosed during the intrusion of alkaline rocks. The entire intrusive complex occurs in a highly deformed synclinal belt that developed along the western margin of North America during Mesozoic time. The structural stresses that developed during the formation of the syncline and the subsequent intrusion of alkaline rocks created zones of faulting, brecciation and fracturing in the older rocks, many of which were later mineralized by hydrothermal solutions passing through the broken rock.

The main ore deposit developed in the alkaline rocks and consists of an "S" shaped core of high-grade ore that mined out at about one percent  $U_3O_8$ . The ore zone was 6 to 25 feet thick. The high-grade core was more or less surrounded by a halo of low-grade mineralization, limited primarily to parallel structures and related veins. In fact, existing ore reserves are confined mostly to a parallel shear zone and a minor structural pattern which trends 40 to 60 degrees of the main shear zone.

The dominant ore minerals are uranothorite and uranian thorianite. The uranium minerals are probably syngenetic to the intrusion of alkaline rock, and show further concentration as a result of alteration during the period of hydrothermal activity. Mineralization precipitated in the older rocks at that time. Coffinite occurs as a minor ore mineral. Rock alteration and the occurrence of anomalous concentrations of uranium minerals in association with hematite, fluorite, zircon and thorium in favorable structural traps (faults, breccia and fractures) confirms the movement of mineral-rich solutions throughout all rock types.

Two small satellite ore deposits are known to occur in the older granites surrounding the Bokan Mountain deposit. Uraninite is the main uranium mineral present. It occurs in close association with hematite and fluorite in highly brecciated and fractured zones. Again, development of the ore deposits is probably a result of mineralized solutions moving along zones of broken rock during and after the intrusion of peralkaline rocks.

**Palabora, South Africa** Uranium at Palabora is contained in a carbonatite segment of the Palabora intrusive complex. Anomalous radioactivity was investigated as early as 1951 at what is now the Palabora mine site. It was determined that the radioactivity was due to the dissemination of minor amounts of uranothorianite associated with low-grade copper sulfide deposit. Ore reserves available by open pit mining methods were estimated at several hundred million tonnes containing an average copper content of 0.7 percent and uranium at 0.004 percent. The uranium that could be recovered as a by-product to copper has been estimated by the South African Atomic Energy Board at 3,000 to 11,000 tonnes  $U_3O_8$ , depending upon the availability of copper ore to the current mining practice. Uranium production during 1979 and 1980 was a total of approximately 530,000 pounds  $U_3O_8$ .

The main orebody at Palabora is a vertical volcanic pipe, referred to as the Looekop pipe, occupying the central core of the Palabora Igneous Complex. The complex consists of "staged" intrusives into a country rock of Precambrian granite gneiss. The last two stages of intrusions consisted of alkaline syenites and carbonatite, both of which occupy the Looekop pipe. The central core of carbonatite is the main host for the concentration of copper sulfides and associ-

## RAW MATERIALS

ated minerals. Important concentrations of magnetite occur in the carbonatite and in the syenites along the outer edges of the pipe.

All mineralization in the pipe has accumulated in veinlets of the highly fractured portions of the carbonatite as a result of mineralizing solutions flooding the fractured zones. The veinlets are completely cemented by copper sulfides.

Important accessory minerals, in addition to uranothorianite, include magnetite, babbeyleyite, galena, gold, silver and several nickel-bearing sulfide ores. All by-product minerals occur in small percentages and are recoverable only because of the large scale operations at Palabora.

### Summary

The concentration of uranium in alkaline rocks is notably low, with the exception of the Bokan

Mountain deposit. The favorable criteria for such deposits suggests that the occurrence of low-grade uranium will be the rule, high-grade uranium will be the exception. It can be concluded that a uranium-bearing alkaline occurrence would be exploitable only if it is very large and contains an accessory mineral of greater economic importance than uranium. The Pocos de Caldos and Palabora occurrences are examples of this. The world supply demand situation for  $U_3O_8$  will influence exploration groups in their search for alkaline uranium occurrences. Under present circumstances, it is probable that any new uranium discoveries in alkaline rocks will be incidental to the search for more economically important minerals.

STATISTICAL DATA

**EXCHANGE VALUE—\$27.00/lb U<sub>3</sub>O<sub>8</sub>**  
Determined as of December 31, 1980

**Definition**

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

- A. Data from recently completed transactions.
- B. Data from pending transactions.
- C. Firm bids to buy and firm offers to sell.
- D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

- A. The price of uranium delivered or to be delivered under old contracts.
- B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

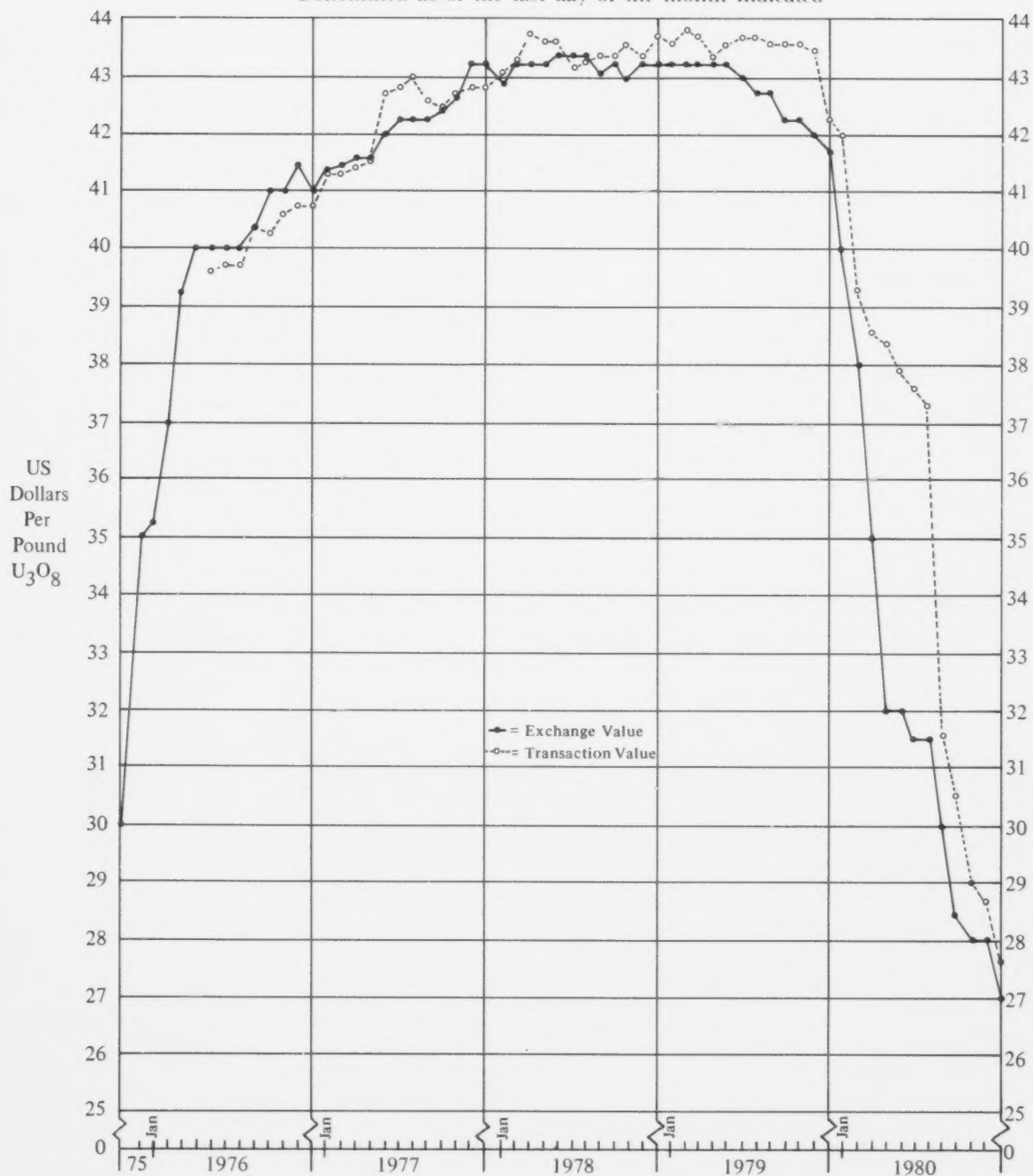
| TRANSACTION VALUE                   |                    |                        |                  |
|-------------------------------------|--------------------|------------------------|------------------|
| Determined as of December 31, 1980  |                    |                        |                  |
| \$/lb U <sub>3</sub> O <sub>8</sub> | Millions of Pounds | Number of Transactions | Number of Months |
| 27.70                               | 2.7                | 10                     | 4                |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U<sub>3</sub>O<sub>8</sub> in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds U<sub>3</sub>O<sub>8</sub> are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

STATISTICAL DATA

EXCHANGE AND TRANSACTION VALUES  
SINCE NOVEMBER 1975  
Determined as of the last day of the month indicated



## STATISTICAL DATA

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated  
(U'S Dollars lb. U'sOs)

|      | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1968 | —     | —     | —     | —     | —     | —     | —     | 6.35  | 6.35  | 6.40  | 6.45  | 6.50  |
| 1969 | —     | 6.35  | 6.10  | 6.10  | 6.25  | 6.25  | 6.20  | 6.20  | 6.15  | 6.15  | 6.15  | 6.20  |
| 1970 | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.20  | 6.15  | 6.15  | 6.15  | 6.15  |
| 1971 | 6.20  | 6.20  | 6.20  | 6.20  | 6.15  | 6.05  | 6.00  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  |
| 1972 | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  |
| 1973 | 5.95  | 6.00  | 6.10  | 6.20  | 6.45  | 6.50  | 6.50  | 6.50  | 6.50  | 6.50  | 6.75  | 7.00  |
| 1974 | 7.70  | 7.90  | 8.00  | 9.00  | 9.50  | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |

Note: See earlier Nuexco Reports for evolution of the definition of Exchange Value.

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated  
(U'S Dollars lb. U'sOs)

|      | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1976 | —     | —     | —     | —     | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |

Note: See Nuexco Report 135 for a discussion of the definition of Transaction Value.

STATISTICAL DATA

EXCHANGE VALUE EXPRESSED IN SELECTED  
PRODUCER & CONSUMER CURRENCIES\*

| Country             | per lb U <sub>3</sub> O <sub>8</sub><br>in Concentrates | per kg U <sub>3</sub> O <sub>8</sub><br>in Concentrates | per kg U<br>in Concentrates |
|---------------------|---------------------------------------------------------|---------------------------------------------------------|-----------------------------|
| US (dollar)         | 27.00                                                   | 59.52                                                   | 70.19                       |
| France (franc)      | 122.06                                                  | 269.10                                                  | 317.33                      |
| FRG (mark)          | 52.95                                                   | 116.74                                                  | 137.66                      |
| Japan (yen)         | 5,476                                                   | 12,072                                                  | 14,235                      |
| Switzerland (franc) | 47.79                                                   | 105.35                                                  | 124.24                      |
| UK (pound)          | 11.31                                                   | 24.94                                                   | 29.41                       |
| Australia (dollar)  | 22.85                                                   | 50.38                                                   | 59.42                       |
| Canada (dollar)     | 32.14                                                   | 70.85                                                   | 83.55                       |
| Niger, Gabon (CFA)  | 6,103                                                   | 13,455                                                  | 15,867                      |
| South Africa (rand) | 20.11                                                   | 44.34                                                   | 52.29                       |

\*Calculated using currency exchange rates published in the Wall Street Journal on the last business day of the month.

LOAN USE CHARGE RATE—7.0%/year

Definition

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

Derivation

Nuexco bases the Loan Use Charge Rate upon:

- Data from recently completed or pending loan transactions.
- Rates included in firm proposals to borrow or lend.
- Rates that potential borrowers and lenders have expressed a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.



## STATISTICAL DATA

### CURRENT TRANSACTIONS\*

| Nuexco<br>Reference<br>Number | Delivery<br>Period | Approximate Quantity<br>(thousands of pounds,<br>UsOs equivalent) | Approximate<br>Price as<br>percent of<br>Current E.V. | Seller<br>Group | Buyer<br>Group | Remarks                           |
|-------------------------------|--------------------|-------------------------------------------------------------------|-------------------------------------------------------|-----------------|----------------|-----------------------------------|
| 1302                          | 80-81              | 301 - 600                                                         | 101                                                   | US              | US             |                                   |
| 1325                          | 80                 | Less than 50                                                      | —                                                     | US              | US             | Not an arms-length<br>transaction |

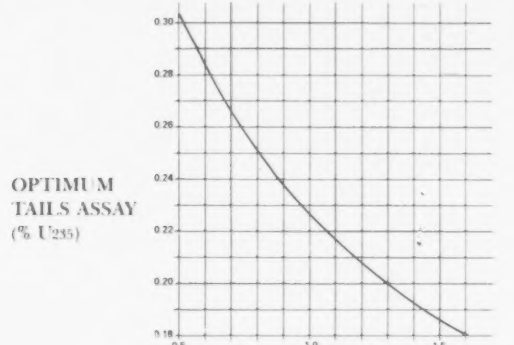
\*Transactions listed include not only those in which Nuexco was involved, but also all others of which Nuexco is aware.

STATISTICAL DATA

OPTIMUM TAILS ASSAY

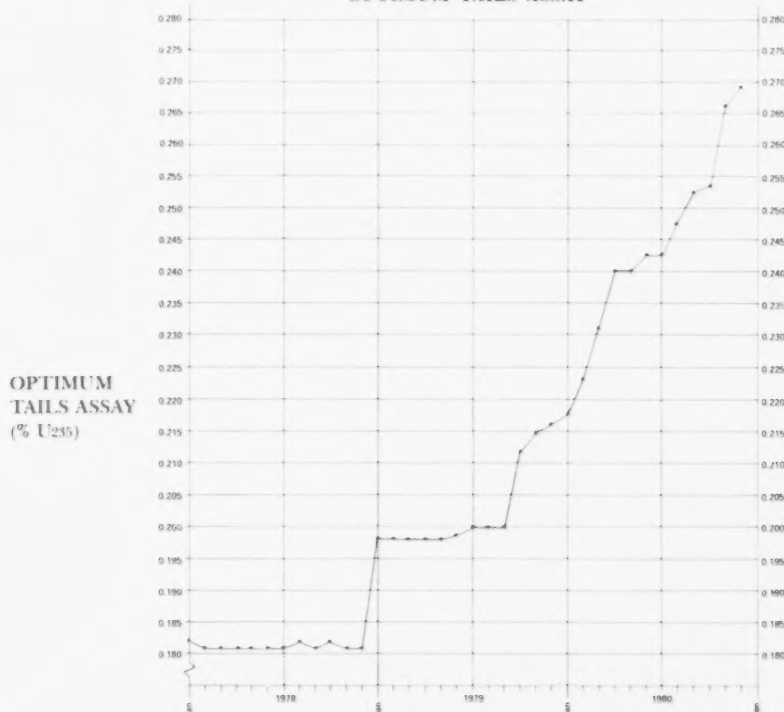
The optimum tails assay is the tails composition at which the cost of enriched uranium is lowest for given costs of separative work (SWU) and natural uranium feed. It depends only on the ratio of the cost of a kilogram of natural uranium in the form of  $UF_6$  to the cost of a kilogram unit of separative work. The US Department of Energy (USDOE) Adjustable Fixed Commitment (AFC) enrichment contract holders have the option, within limits, to specify the transaction tails assay. The transaction tails assay for USDOE Requirements contracts is 0.2 percent  $U_{235}$ . For every one-hundredth of one percent increase in the transaction tails assay, uranium consumption increases about two percent.

TAILS ASSAY FOR MINIMUM COST OF PRODUCT\*



\*From Nuexco Report 138

OPTIMUM TAILS ASSAY<sup>1</sup>



## STATISTICAL DATA

## US GOVERNMENT STATISTICS

|                                 | Producer Price<br>Index—Industrial<br>Commodities<br>(1967 = 100) <sup>1</sup> | Consumer<br>Price<br>Index<br>(1967 = 100) <sup>2</sup> | GNP<br>Implicit<br>Price<br>Deflator<br>(1972 = 100) <sup>3</sup> | Gross Average Hourly Earnings<br>of Production or Non-supervisory<br>Workers (US\$) <sup>4</sup> |                                               |                                                 |
|---------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------|
|                                 |                                                                                |                                                         |                                                                   | Metal<br>Mining<br>(SIC 10)                                                                      | Primary<br>Non-ferrous<br>Metals<br>(SIC 333) | Chemicals<br>and Allied<br>Products<br>(SIC 28) |
| Annual Avg. 1970 <sup>(5)</sup> | 110.0                                                                          | 116.3                                                   | 91.36                                                             | 3.88                                                                                             | 3.87                                          | 3.69                                            |
| Annual Avg. 1971 <sup>(5)</sup> | 114.1                                                                          | 121.3                                                   | 96.02                                                             | 4.12                                                                                             | 4.15                                          | 3.97                                            |
| Annual Avg. 1972 <sup>(5)</sup> | 117.9                                                                          | 125.3                                                   | 100.00                                                            | 4.56                                                                                             | 4.59                                          | 4.26                                            |
| Annual Avg. 1973 <sup>(5)</sup> | 125.9                                                                          | 133.1                                                   | 105.80                                                            | 4.84                                                                                             | 4.98                                          | 4.51                                            |
| Annual Avg. 1974 <sup>(5)</sup> | 153.8                                                                          | 147.7                                                   | 116.02                                                            | 5.44                                                                                             | 5.63                                          | 4.88                                            |
| Annual Avg. 1975 <sup>(5)</sup> | 171.5                                                                          | 161.2                                                   | 127.15                                                            | 6.13                                                                                             | 6.24                                          | 5.39                                            |
| Annual Avg. 1976 <sup>(5)</sup> | 182.4                                                                          | 170.5                                                   | 133.71                                                            | 6.76                                                                                             | 6.87                                          | 5.91                                            |
| Annual Avg. 1977 <sup>(6)</sup> | 195.1                                                                          | 181.5                                                   | 141.70                                                            | 7.28                                                                                             | 7.67                                          | 6.43                                            |
| Annual Avg. 1978 <sup>(6)</sup> | 209.4                                                                          | 195.4                                                   | 152.05                                                            | 8.23                                                                                             | 8.56                                          | 7.02                                            |
| Annual Avg. 1979 <sup>(6)</sup> | 236.5                                                                          | 217.4                                                   | 165.46                                                            | 9.27                                                                                             | 9.49                                          | 7.60                                            |
| Sep 1979                        | 244.2                                                                          | 223.4                                                   | 167.20                                                            | 9.63                                                                                             | 9.79                                          | 7.74                                            |
| Oct 1979                        | 249.0                                                                          | 225.4                                                   | —                                                                 | 9.67                                                                                             | 9.87                                          | 7.83                                            |
| Nov 1979                        | 250.6                                                                          | 227.5                                                   | —                                                                 | 9.78                                                                                             | 9.85                                          | 7.88                                            |
| Dec 1979                        | 253.1                                                                          | 229.9                                                   | 170.58                                                            | 9.80                                                                                             | 9.92                                          | 7.92                                            |
| Jan 1980                        | 260.6                                                                          | 233.2                                                   | —                                                                 | 9.91                                                                                             | 10.06                                         | 7.97                                            |
| Feb 1980                        | 265.9                                                                          | 236.4                                                   | —                                                                 | 9.92                                                                                             | 10.01                                         | 8.01                                            |
| Mar 1980                        | 268.6                                                                          | 239.8                                                   | 174.48                                                            | 9.90                                                                                             | 10.22                                         | 8.05                                            |
| Apr 1980                        | 271.3                                                                          | 242.5                                                   | —                                                                 | 10.00                                                                                            | 10.30                                         | 8.12                                            |
| May 1980                        | 271.2R                                                                         | 244.9                                                   | —                                                                 | 10.18                                                                                            | 10.37                                         | 8.17                                            |
| Jun 1980                        | 273.0R                                                                         | 247.6                                                   | 178.93                                                            | 10.13                                                                                            | 10.69                                         | 8.24                                            |
| Jul 1980                        | 276.2R                                                                         | 247.8                                                   | —                                                                 | 10.24                                                                                            | 10.82                                         | 8.35                                            |
| Aug 1980                        | 277.3                                                                          | 249.4                                                   | —                                                                 | 10.38                                                                                            | 10.78                                         | 8.39                                            |
| Sep 1980                        | 278.2                                                                          | 251.7                                                   | 182.92                                                            | 10.54                                                                                            | 10.94                                         | 8.46                                            |
| Oct 1980                        | 281.2P                                                                         | 253.9                                                   | —                                                                 | 10.64P                                                                                           | 10.95P                                        | 8.52P                                           |
| Nov 1980                        | 282.7P                                                                         | 256.2                                                   | —                                                                 | —                                                                                                | —                                             | 8.60P                                           |

P = Preliminary R = Revised since last month

(1) US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

(2) US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

(3) US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

(4) US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for January 1977 and beyond are adjusted to the March 1979 benchmark.

(5) Data for 1970-1976, monthly except for the GNP Implicit Price Deflator, and Price Index data for 1977-1978 appear on pages 4.6-4.8 of Nuexco Report 139.

(6) Employment and Earnings data for 1977-1979, monthly, appear on page 33 of Nuexco Report 147.

STATISTICAL DATA

AUSTRALIAN GOVERNMENT STATISTICS

|                                 | Price Index of Materials<br>Used in Manufacturing<br>Industry—All Groups<br>(Year 1968-69 = 100.0) <sup>1</sup> | Weighted Average<br>Minimum Weekly Wage<br>Rates—Adult Males<br>Australia<br>Mining and Quarrying (AS) <sup>2</sup> |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Annual Avg. 1970 <sup>(3)</sup> | 101.4                                                                                                           | 59.88                                                                                                               |
| Annual Avg. 1971 <sup>(3)</sup> | 101.5                                                                                                           | 65.95                                                                                                               |
| Annual Avg. 1972 <sup>(3)</sup> | 105.6                                                                                                           | 71.26                                                                                                               |
| Annual Avg. 1973 <sup>(3)</sup> | 124.4                                                                                                           | 78.96                                                                                                               |
| Annual Avg. 1974 <sup>(3)</sup> | 141.9                                                                                                           | 108.07                                                                                                              |
| Annual Avg. 1975 <sup>(3)</sup> | 150.4                                                                                                           | 132.55                                                                                                              |
| Annual Avg. 1976 <sup>(3)</sup> | 168.4                                                                                                           | 160.93                                                                                                              |
| Annual Avg. 1977 <sup>(3)</sup> | 192.0                                                                                                           | 179.03                                                                                                              |
| Annual Avg. 1978 <sup>(3)</sup> | 215.4                                                                                                           | 190.04                                                                                                              |
| Annual Avg. 1979                | 248.5                                                                                                           | 196.34                                                                                                              |
| Jul 1979                        | 298.2                                                                                                           | 199.22                                                                                                              |
| Aug 1979                        | 293.2                                                                                                           | 201.43R                                                                                                             |
| Sep 1979                        | 302.4                                                                                                           | 202.24R                                                                                                             |
| Oct 1979                        | 309.4                                                                                                           | 201.70R                                                                                                             |
| Nov 1979                        | 310.4                                                                                                           | 201.05R                                                                                                             |
| Dec 1979                        | 319.4                                                                                                           | 201.85R                                                                                                             |
| Jan 1980                        | 340.1                                                                                                           | 215.71R                                                                                                             |
| Feb 1980                        | 345.6                                                                                                           | 215.18                                                                                                              |
| Mar 1980                        | 340.3                                                                                                           | 214.81                                                                                                              |
| Apr 1980                        | 327.9                                                                                                           | 215.12                                                                                                              |
| May 1980                        | 335.1                                                                                                           | 214.78R                                                                                                             |
| Jun 1980                        | 338.4                                                                                                           | 214.11R                                                                                                             |
| Jul 1980                        | 349.1                                                                                                           | 221.41R                                                                                                             |
| Aug 1980                        | 353.2                                                                                                           | 219.70                                                                                                              |
| Sep 1980                        | 351.6P                                                                                                          | 219.15P                                                                                                             |
| Oct 1980                        | 348.7P                                                                                                          | 219.37P                                                                                                             |

P = Preliminary R = Revised since last month

(1) Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

(2) Australian Bureau of Statistics, Canberra: "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest fourteen months shown are subject to revision.

(3) Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

## STATISTICAL DATA

## CANADIAN GOVERNMENT STATISTICS

|                  | Industry Selling<br>Price Index:<br>Manufacturing<br>(D 500000) <sup>1,2</sup><br>(1971 = 100.0) | Wage-earner Data:<br>Average Hourly Earnings (C\$) <sup>3,4</sup> |                                                              |                                                        |
|------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------|
|                  |                                                                                                  | Metal Mining,<br>including<br>milling<br>(SIC 050-059)            | Primary Metal<br>Industries,<br>non-ferrous<br>(SIC 296-298) | Chemicals and<br>Chemical<br>Products<br>(SIC 370-379) |
| Annual Avg. 1977 | 174.3                                                                                            | 8.18                                                              | 6.50                                                         | 6.51                                                   |
| Annual Avg. 1978 | 190.4                                                                                            | 8.76                                                              | 6.82                                                         | 6.97                                                   |
| Annual Avg. 1979 | 217.9                                                                                            | 9.60                                                              | 7.35                                                         | 7.67                                                   |
| Aug 1979         | 220.0                                                                                            | 9.56                                                              | 7.38                                                         | 7.77                                                   |
| Sep 1979         | 223.4                                                                                            | 9.75                                                              | 7.50                                                         | 7.81                                                   |
| Oct 1979         | 227.4                                                                                            | 9.89                                                              | 7.54                                                         | 7.88                                                   |
| Nov 1979         | 228.1                                                                                            | 9.97                                                              | 7.61                                                         | 7.91                                                   |
| Dec 1979         | 230.4                                                                                            | 9.93                                                              | 7.51                                                         | 7.89                                                   |
| Jan 1980         | 239.0                                                                                            | 9.96                                                              | 7.57                                                         | 7.99                                                   |
| Feb 1980         | 240.8                                                                                            | 10.11                                                             | 7.69                                                         | 8.08                                                   |
| Mar 1980         | 239.5                                                                                            | 10.34                                                             | 7.83                                                         | 8.26                                                   |
| Apr 1980         | 241.1R                                                                                           | 10.40                                                             | 7.94                                                         | 8.36                                                   |
| May 1980         | 242.4                                                                                            | 10.50                                                             | 8.01                                                         | 8.44                                                   |
| Jun 1980         | 243.7                                                                                            | 10.51                                                             | 8.07                                                         | 8.46                                                   |
| Jul 1980         | 246.2                                                                                            | 10.49                                                             | 8.11                                                         | 8.55                                                   |
| Aug 1980         | 249.1R                                                                                           | 10.58P                                                            | 8.14P                                                        | 8.65P                                                  |
| Sep 1980         | 251.6                                                                                            | 10.71P                                                            | 8.26P                                                        | 8.70P                                                  |
| Oct 1980         | 254.9P                                                                                           | —                                                                 | —                                                            | —                                                      |

P = Preliminary R = Revised since last month

(1) Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-611), Table 1. Indexes for the most recent six months shown are subject to revision.

(2) Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

(3) Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

(4) Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

STATISTICAL DATA

REPUBLIC OF SOUTH AFRICA STATISTICS

|                                 | Average Declared Working<br>Costs per Metric Ton of<br>Gold Ore Milled (Rand) <sup>1</sup> | Consumer<br>Price Index <sup>2</sup><br>(1975 = 100, except where<br>otherwise indicated) |
|---------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Annual Avg. 1970 <sup>(3)</sup> | 7.34                                                                                       | 100.3 <sup>(4)</sup>                                                                      |
| Annual Avg. 1971 <sup>(3)</sup> | 7.88                                                                                       | 106.4 <sup>(4)</sup>                                                                      |
| Annual Avg. 1972 <sup>(3)</sup> | 8.79                                                                                       | 113.3 <sup>(4)</sup>                                                                      |
| Annual Avg. 1973 <sup>(3)</sup> | 10.51                                                                                      | 124.1 <sup>(4)</sup>                                                                      |
| Annual Avg. 1974 <sup>(3)</sup> | 13.18                                                                                      | 138.5 <sup>(4)</sup>                                                                      |
| Annual Avg. 1975 <sup>(3)</sup> | 16.71                                                                                      | 157.2 <sup>(4)</sup>                                                                      |
| Annual Avg. 1976 <sup>(3)</sup> | 19.30                                                                                      | 174.7 <sup>(4)</sup>                                                                      |
| Annual Avg. 1977 <sup>(3)</sup> | 23.87                                                                                      | 194.4 <sup>(4)</sup>                                                                      |
| Annual Avg. 1978 <sup>(3)</sup> | 27.14                                                                                      | 137.2                                                                                     |
| Annual Avg. 1979 <sup>(3)</sup> | 30.18                                                                                      | 155.3                                                                                     |
| Sep 1979                        | 30.71                                                                                      | 162.1                                                                                     |
| Oct 1979                        | —                                                                                          | 162.9                                                                                     |
| Nov 1979                        | —                                                                                          | 163.4                                                                                     |
| Dec 1979                        | 31.89                                                                                      | 164.0                                                                                     |
| Jan 1980                        | —                                                                                          | 165.4                                                                                     |
| Feb 1980                        | —                                                                                          | 167.0                                                                                     |
| Mar 1980                        | 33.65                                                                                      | 168.0                                                                                     |
| Apr 1980                        | —                                                                                          | 170.0                                                                                     |
| May 1980                        | —                                                                                          | 171.9                                                                                     |
| Jun 1980                        | 34.48R                                                                                     | 174.6                                                                                     |
| Jul 1980                        | —                                                                                          | 177.2                                                                                     |
| Aug 1980                        | —                                                                                          | 179.2                                                                                     |
| Sep 1980                        | 36.19                                                                                      | 182.8                                                                                     |
| Oct 1980                        | —                                                                                          | 186.3                                                                                     |
| Nov 1980                        | —                                                                                          | 187.8                                                                                     |

(1) Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

(2) Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

(3) Historical data for 1970 through 1979 appear on page 4.9 of Nuexco Report 140.

(4) April 1970 = 100.00



# MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

## URANIUM SUPPLY

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U3Os) |              |              | Remarks   |
|-------------------------------|------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                    | 1 to 2 Years | 2 to 3 Years |           |
| Available for Sale:           |                                                |              |              |           |
| 1392                          | 200                                            |              |              |           |
| 1393                          | 60                                             | 175          | 175          | Long term |
| 1475                          | 1000                                           |              |              | UF6       |
| 1480                          | 500                                            |              |              |           |
| 1481                          | 250                                            |              |              |           |
| 1490                          | 1000                                           |              |              |           |
| 1533                          | 400                                            |              |              |           |
| 1534                          | 400                                            |              |              |           |
| 1540                          | 750                                            |              |              | UF6       |
| 1547                          | 100                                            |              |              |           |
| 1550                          | 1000                                           |              |              | UF6       |
| 1551                          | 150                                            |              |              |           |
| 1552                          | 600                                            |              |              |           |
| 1559                          | 300                                            |              |              |           |
| 1562                          |                                                | 150          | 150          | Long term |
| 1570                          | 600                                            |              |              |           |
| 1571                          | 30                                             |              |              |           |
| 1576                          | 200                                            |              |              |           |
| 1577                          |                                                | 300          |              |           |
| TOTALS                        | 7540                                           | 625          | 325          |           |

## Available for Loan:

|       |      |  |  |                 |
|-------|------|--|--|-----------------|
| 1429  | 500  |  |  |                 |
| 1492  | 900  |  |  | UF <sub>6</sub> |
| 1520  | 1000 |  |  | UF <sub>6</sub> |
| 1531  | 500  |  |  | UF <sub>6</sub> |
| TOTAL | 2900 |  |  |                 |

\*Measured from the date of this Report.

MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

URANIUM DEMAND

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U3O8) |              |              | Remarks   |
|-------------------------------|------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                    | 1 to 2 Years | 2 to 3 Years |           |
| Inquiries to Purchase:        |                                                |              |              |           |
| 1459                          |                                                | 200          | 200          | Long term |
| 1462                          |                                                |              | 100          | Long term |
| 1513                          | 200                                            |              |              |           |
| 1529                          |                                                |              | 550          | Long term |
| TOTALS                        | 200                                            | 200          | 850          |           |

**Inquiries to Borrow:**

|       |     |  |
|-------|-----|--|
| 1553  | 900 |  |
| TOTAL | 900 |  |

\*Measured from the date of this Report.

# MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the secondary market for UF<sub>6</sub> conversion services. The data presented in this section are in no way intended to be indicative of the entire market for the time period covered.

## CONVERSION SUPPLY

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U as UF <sub>6</sub> ) |              |              | Remarks |
|-------------------------------|-----------------------------------------------------------------|--------------|--------------|---------|
|                               | 0 to 1 Year                                                     | 1 to 2 Years | 2 to 3 Years |         |
| 1451                          | 150                                                             |              |              |         |
| 1475                          | 850                                                             |              |              |         |
| 1540                          | 650                                                             |              |              |         |
| TOTAL                         | 1650                                                            |              |              |         |

## CONVERSION DEMAND

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U as UF <sub>6</sub> ) |              |              | Remarks |
|-------------------------------|-----------------------------------------------------------------|--------------|--------------|---------|
|                               | 0 to 1 Year                                                     | 1 to 2 Years | 2 to 3 Years |         |
| 1488                          | 100                                                             |              |              |         |
| 1532                          | 750                                                             |              |              |         |
| TOTAL                         | 850                                                             |              |              |         |

\*Measured from the date of this Report.

INDEX

URANIUM MARKET INDEX

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| Projected US & Free World Production              |               |     | 1.0 |     | 1.2 |      |     |     |     |     |     | 7   |   |  |
| Actual US & Free World Production                 |               | 1.5 |     |     | 1.5 |      |     | 5   |     |     |     | 12  |   |  |
| US Import-Export Balance                          |               |     |     |     |     | 6    | 4   |     |     |     |     | 11  |   |  |
| Apparent Future Consumption Estimate              |               | 1.1 |     |     |     | 2, 4 |     | 2   |     |     |     | 2   |   |  |
| USDOE Forecast of Uranium Requirements            |               |     |     |     |     |      |     | 7   |     |     |     |     |   |  |
| Uranium Supply & Demand Balance                   |               |     |     |     |     | 1    |     |     | 1   | 9   |     | 10  |   |  |
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## EXECUTIVE SUMMARY & INDUSTRY OVERVIEW NUEXCO REPORT 149

The **Exchange Value** declined to \$27.00 per pound U<sub>3</sub>O<sub>8</sub> from \$28.00 the previous month. The total of inquiries to sell in the spot and near term markets was about 7.5 million pounds U<sub>3</sub>O<sub>8</sub> equivalent, while the total of inquiries to purchase in the same time frame was relatively small. This imbalance alone put some downward pressure on the market, as some sellers reduced their offering prices somewhat. However most potential buyers have indicated a willingness to purchase only at much lower prices. Thus there is currently a substantial difference, about two to three dollars per pound, between bid and asked price levels.

The **Transaction Value** declined to \$27.70 per pound U<sub>3</sub>O<sub>8</sub> from \$28.70 the previous month. Two transactions closed, both involving sales from US producers to US producers; the prices were lower than the previous month's Exchange Value.

The **Japanese** government recently adopted an official target for non-oil energy supplies designed to reduce reliance on imported oil from the present 73 percent to 50 percent by 1990. As a part of this plan, it is intended that nuclear generating capacity will be increased from the current 15,000 MWe to between 51,000 and 53,000 MWe by 1990.

The future of **US** energy policy under the new administration was given direction in a report by President-elect Reagan's energy advisors headed by Michael Harbouty. The Harbouty Report, which calls for the revitalization of the US nuclear power program, is outlined in the *Commentary* section of this Nuexco Report.

A significant portion of the world's uranium production is *captive* to the end user of the uranium. The magnitude and influence of captive production on world uranium market is discussed in the *Topical Essay* of this Report.

The *Raw Materials* essay in this Report is a summary of major world uranium occurrences in alkaline rocks.

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**NUEXCO**

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**FEBRUARY 1981**

**NUMBER 150**

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Monthly  
Report on  
the Uranium  
Market

# NUEXCO

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# NUEXCO

## MONTHLY REPORT ON THE URANIUM MARKET

February 1981

No. 150

JAMES E. VAUGHAN, *EDITOR*

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# NUEXCO

## *FOREWORD*

We are happy to announce that Judy Sellers has joined the Nuexco staff as a Market Analyst. Judy came to Nuexco from Phillips Uranium Company. She is a graduate of the University of California at Berkeley where she majored in economics.



## URANIUM MARKET

### GENERAL

#### Uranium Production in 1980

Nuexco's preliminary estimates of uranium production for the major uranium producing nations in 1980 are summarized in Table 1. Production for 1979 is also shown for comparison.

Table 1

ESTIMATED URANIUM PRODUCTION  
(millions of pounds  $U_3O_8$ )

|                          | 1979 | 1980  |
|--------------------------|------|-------|
| United States            | 37.6 | 42.5  |
| Australia                | 1.8  | 3.9   |
| Canada                   | 17.8 | 18.7  |
| Republic of South Africa | 12.5 | 15.7  |
| Other Africa             | 22.2 | 23.4  |
| France                   | 5.2  | 5.6   |
| TOTAL                    | 97.1 | 110.8 |

Production in 1980 increased by 14 percent over 1979 to a total of 110.8 million pounds  $U_3O_8$ . The biggest changes were in the US and the Republic of South Africa.

Nuexco had previously estimated that US production would decline in 1980 by as much as ten percent from the 37.6 million pounds  $U_3O_8$  produced in 1979. In fact it appears that US production *increased* by ten percent in 1980. Due to the weakening price situation, Nuexco had suggested that many US production centers would cut back in 1980. Actually many cutbacks and layoffs were announced during the year, but these generally did not impact on 1980 concentrate production levels. The main reasons for this were the existence of substantial ore stockpiles which were fed into mills notwithstanding cutbacks in mining efforts. Also, there turned out to be a longer-than-expected lag time between the fall in the market and the implementation of reduced production. Finally the nature of the open pit mining operation makes for a substantial additional lag time in phasing down output. If workers involved in stripping overburden are laid off, the effect on ore output is usually not felt until six to nine months later. The progressive nature of the open pit mine usually requires that overburden be removed well in advance of mining the ore.

An additional 8.3 million pounds  $U_3O_8$  were

produced in the US in 1980 above Nuexco's mid year estimate of 34.2 million pounds. All of this additional material was produced from conventional mines and mills. The distribution by state is as follows, in millions of pounds  $U_3O_8$ :

|            |     |
|------------|-----|
| New Mexico | 4.2 |
| Wyoming    | 2.2 |
| Texas      | 1.3 |
| Others     | 0.6 |
| TOTAL      | 8.3 |

Approximately 80 percent of the unexpected production came from operations controlled by multinational companies. About 70 percent of the additional 8.3 million pounds was produced in open pit operations. Of the total, 5.2 million pounds  $U_3O_8$  were added to inventories, over and above previous Nuexco inventory figures. (3.3 million pounds of which were added to user inventories in the form of additional contract deliveries; 1.9 million pounds were added to producer inventories in the form of unsold or undelivered production.) The balance of 3.1 million pounds was previously expected by Nuexco to be purchased by producers for redelivery under contracts, however the material was in fact produced.

In the Republic of South Africa, production increased in 1980 by a total of about 25 percent, to 15.7 million pounds  $U_3O_8$ . The increase was mainly due to:

1. The Chemwes plant reaching full rated output (188 percent production increase over 1979).
2. The new Vaal Reefs South Plant building up to rated capacity (38 percent increase over 1979).
3. Additional capacity coming on line at JMS (45 percent increase over 1979).
4. Randfontein building up to rated capacity and solving startup metallurgical problems (56 percent increase over 1979).
5. Ergo having improved metallurgical efficiencies (23 percent increase over 1979).

The increase in Australia production was mainly due to the 1980 startup of Queensland Mines Nabarlek mill. The increase in Canada was largely the result of the full year's operation of Rio Algom's Panel mill. The increase in Africa was due to the expanded capacity of the Arlit facility in Niger.

#### Nuclear Generation in 1980

Total nuclear electric generation for North

## URANIUM MARKET

America, Western Europe and the Far East are tabulated in Table 2 for 1980. The years 1978 and 1979 are also shown for comparison. Nuclear generation decreased in the US from the previous year. France, Japan and Sweden all had substantial gains from 1979. Total nuclear electric production for the three regions increased to 610 million megawatt hours, an eight percent overall gain from 1979.

**Table 2**  
**NUCLEAR ELECTRIC POWER GENERATION**  
(millions of megawatt-hours, gross)

|                        | 1978       | 1979       | 1980       |
|------------------------|------------|------------|------------|
| <i>North America</i>   |            |            |            |
| Canada                 | 33         | 38         | 40         |
| United States          | 293        | 271        | 265        |
| Total North America    | 326        | 309        | 305        |
| <i>Western Europe</i>  |            |            |            |
| Belgium                | 13         | 12         | 12         |
| Finland                | 3          | 7          | 7          |
| France                 | 31         | 40         | 61         |
| FRG                    | 33         | 40         | 44         |
| Italy                  | 4          | 3          | 2          |
| Netherlands            | 4          | 4          | 4          |
| Spain                  | 8          | 7          | 5          |
| Sweden                 | 21         | 21         | 27         |
| Switzerland            | 8          | 12         | 14         |
| UK                     | 37         | 39         | 37         |
| Total Western Europe   | 165        | 185        | 213        |
| <i>Far East</i>        |            |            |            |
| Japan                  | 51         | 62         | 81         |
| Rep. of China (Taiwan) | 3          | 6          | 8          |
| Rep. of Korea          | 2          | 3          | 3          |
| Total Far East         | 56         | 71         | 92         |
| <b>TOTAL</b>           | <b>547</b> | <b>565</b> | <b>610</b> |

Sweden and Switzerland continue to lead in total relative dependence on nuclear power. About 27 percent of Sweden's production in 1980 was nuclear, and during the last annual accounting period about 27 percent of Switzerland's production was nuclear. Approximate nuclear shares for other European nations include Belgium 23 percent; France 22 percent; and UK and FRG at 12 percent each. In the Far East, the nuclear power dependence of Japan was about 13 percent, Taiwan 19 percent and Korea seven

percent. In North America, nuclear dependence of the US was about 12 percent. In the Province of Ontario, Canada, nuclear production was about 30 percent of total production.

The US percentage of total generation has decreased from 54 percent in 1978 to 48 percent in 1979 and 43 percent in 1980.

### Transactions in 1980

The year 1980 saw a significant erosion of prices, and the size, quantity, and flow of transactions followed a dramatic swing to a buyer's market. Table 3 details the transactions reported in the Nuexco Monthly Report during 1980 by geographical region.

US sellers dominated spot and near term activity. Some 69 percent of the material transferred in spot and near term transactions involved US sellers. However, longer term transactions were dominated by non-US sellers.

Australian producers had an active year, as their longer term transactions represented almost 30 percent of the total. The dominance of Australian activity in 1980 is highlighted by the fact that the figures in Table 3 do not include transactions between Energy Resources of Australia (ERA) and its Japanese and German shareholders. These ERA transactions are described in detail in the *Australia* section of this Report.

Canada and Africa continued to emphasize longer term marketing, and each captured a sizeable portion of this market. The generally aggressive Canadians also participated actively in the spot market.

On the buy side, European buyers were very active in 1980 in both the spot and longer term market as the nuclear programs of several nations cleared hurdles and purchases were made in anticipation of nuclear expansion. European buyers tended to spread their purchases among African, US, Australian, and Canadian producers.

This same diversification of supply was shown by buyers in the Far East. These buyers have generally ignored the spot market, and 1980 was no exception. Despite an apparently comfortable inventory position, contracts were signed for a significant quantity of long term material by Far East buyers.

Table 4 is an update of a table first presented in Nuexco Report 147 showing the breakdown of sales between producers and nonproducers for 1980. It incorporates the last two months of 1980 as well as



## URANIUM MARKET

**Table 3**  
**SUMMARY OF TRANSACTIONS REPORTED IN THE**  
**NUEXCO MONTHLY REPORT DURING 1980<sup>1</sup>**  
(number of transactions and thousands of pounds U<sub>3</sub>O<sub>8</sub> involved)

| <b>SPOT AND NEAR TERM TRANSACTIONS<sup>2</sup></b> |                               |                 |                               |                  |                    |
|----------------------------------------------------|-------------------------------|-----------------|-------------------------------|------------------|--------------------|
| <b>Seller Group</b>                                | <b>Buyer Group</b>            |                 |                               |                  | <b>Total</b>       |
|                                                    | <b>Europe</b>                 | <b>Far East</b> | <b>US</b>                     | <b>Other</b>     |                    |
| Africa                                             | —                             | —               | —                             | 2 (1,000)        | 2 (1,000)          |
| Australia                                          | —                             | —               | —                             | —                | —                  |
| Canada                                             | 1 (300)                       | —               | 1 (800)                       | 1 (100)          | 3 (1,200)          |
| USA                                                | 9 (2,200)                     | 1 (*)           | 32 (6,100) <sup>3</sup>       | 1 (*)            | 43 (8,300)         |
| Other                                              | 5 (1,000) <sup>4</sup>        | 1 (*)           | 1 (200)                       | 1 (400)          | 8 (1,600)          |
| <b>TOTALS</b>                                      | <b>15 (3,500)<sup>4</sup></b> | <b>2 (*)</b>    | <b>34 (7,100)<sup>3</sup></b> | <b>5 (1,500)</b> | <b>56 (12,100)</b> |

| <b>LONGER TERM TRANSACTIONS<sup>2</sup></b> |                        |                        |                  |                      |                         |
|---------------------------------------------|------------------------|------------------------|------------------|----------------------|-------------------------|
| <b>Seller Group</b>                         | <b>Buyer Group</b>     |                        |                  |                      | <b>Total</b>            |
|                                             | <b>Europe</b>          | <b>Far East</b>        | <b>USA</b>       | <b>Other</b>         |                         |
| Africa                                      | 2 (8,700)              | 1 (8,000)              | —                | —                    | 3 (16,700)              |
| Australia <sup>6</sup>                      | 2 (4,800) <sup>6</sup> | 1 (3,000) <sup>6</sup> | 1 (4,500)        | —                    | 4 (12,300) <sup>6</sup> |
| Canada                                      | —                      | 1 (4,200)              | —                | —                    | 1 (4,200)               |
| USA                                         | 4 (1,600)              | 1 (3,100)              | 2 (3,400)        | —                    | 7 (8,100)               |
| Other                                       | —                      | —                      | —                | 1 (600) <sup>5</sup> | 1 (600)                 |
| <b>TOTALS</b>                               | <b>8 (15,100)</b>      | <b>4 (18,300)</b>      | <b>3 (7,400)</b> | <b>1 (600)</b>       | <b>16 (41,900)</b>      |

<sup>1</sup>Nuexco Reports 138 through 149.

<sup>2</sup>Near Term means delivery within one year after contract signature. Longer Term means final delivery more than one year after contract signature.

<sup>3</sup>Includes four loans totalling 900,000 lbs U<sub>3</sub>O<sub>8</sub> equivalent and two U<sub>3</sub>O<sub>8</sub>-UF<sub>6</sub> swaps totalling 400,000 lbs U<sub>3</sub>O<sub>8</sub> equivalent.

<sup>4</sup>Includes 1 loan totalling 100,000 lbs U<sub>3</sub>O<sub>8</sub>.

<sup>5</sup>Includes 1 loan totalling 600,000 lbs U<sub>3</sub>O<sub>8</sub>.

<sup>6</sup>Totals for Australia do not include 1980 Transactions between Energy Resources of Australia and its Japanese and German shareholders. These FRA Transactions are described in detail in the Australia Section of this Report.

\*Quantities less than 50,000 pounds U<sub>3</sub>O<sub>8</sub>.

URANIUM MARKET

Table 4  
SPOT AND NEAR TERM<sup>1</sup> SALES TRANSACTIONS REPORTED IN THE  
NUEXCO MONTHLY REPORT DURING 1980<sup>2</sup>  
(number of transactions and thousands of pounds U<sub>3</sub>O<sub>8</sub> involved)

| Seller                       | Buyer          |                    |                    |                        | Total       |
|------------------------------|----------------|--------------------|--------------------|------------------------|-------------|
|                              | US<br>Producer | US<br>Non-Producer | Non-US<br>Producer | Non-US<br>Non-Producer |             |
| US Producer <sup>3</sup>     | 9 (1,475)      | 8 (1,591)          | —                  | 8 (1,371)              | 25 (4,437)  |
| US Non-Producer <sup>4</sup> | 6 (1,055)      | 4 (1,176)          | —                  | 3 (385)                | 13 (2,616)  |
| Non-US Producer              | —              | 1 (750)            | 2 (370)            | 5 (2,092)              | 8 (3,212)   |
| Non-US Non-Producer          | —              | 1 (210)            | 1 (210)            | 1 (28)                 | 3 (448)     |
| TOTALS                       | 15 (2,530)     | 14 (3,727)         | 3 (580)            | 17 (3,876)             | 49 (10,713) |

<sup>1</sup>Near term means delivery within one year after contract signature.

<sup>2</sup>Nuexco Reports 138 through 149.

<sup>3</sup>"Producer" means companies directly involved in mining uranium.

<sup>4</sup>"Non-producer" includes utilities, government agencies, fuel fabricators and others not directly involved in mining uranium.

new information about previously tabulated transactions. In comparing Table 4 with the earlier version in Report 147, it seems that the trend of utility sales and producer purchases has increased, especially in the US.

The figures in Table 3 suggest that the major change in marketing during 1980 was the shift in emphasis away from the US, both as a producer and as a consumer. The relative stagnation of the US nuclear power industry indicated that non-US producers would increasingly look to the more active non-US markets. Meanwhile, the status of most US producers as the marginal cost producers of the world generally led to buyers' looking elsewhere for longer term contracts. There was very little long term activity by US buyers, especially with non-US sellers.

#### AUSTRALIA

A contract was announced this month between Oskarshamnsverkets Kraftgrupp Aktiebolag (OKG) of Sweden and Uranium Resources of Australia (ERA). The contract is for a total of 6.3 million pounds U<sub>3</sub>O<sub>8</sub> with deliveries extending from 1982 through 1996. OKG also acquired a one percent equity interest in ERA. The current share holdings in ERA are set forth in Table 5. Table 6 summarizes the existing sales commitments of ERA. The nominal capacity of the Ranger mill is 6.6 million pounds U<sub>3</sub>O<sub>8</sub> per year,

so the facility is now essentially fully committed through 1990.

Table 5  
SHAREHOLDERS OF ENERGY RESOURCES  
OF AUSTRALIA (ERA)

| Shareholder                                     | Percent |
|-------------------------------------------------|---------|
| Peko-Wallsend                                   | 30.49   |
| EZ Industries                                   | 30.49   |
| Australia public                                | 14.02   |
| JAURD                                           | 10.00   |
| UG Australia Development<br>(Urangesellschaft)  | 4.00    |
| Inter-uranium Australia<br>(Saarberg-Interplan) | 3.75    |
| Rheinische Braunkohlenwerke (RWE)               | 6.25    |
| OKG                                             | 1.00    |

#### EUROPE

Several new nuclear units in the Comecon group of countries have recently become operational, or are nearly ready:

1. The first unit of the nuclear unit at Rovno in the West Ukraine was placed into operation in December 1980. This unit is a 440 MWe PWR. A second identical unit is under construction at this site.

## URANIUM MARKET

Table 6  
ENERGY RESOURCES OF AUSTRALIA (ERA) SALES COMMITMENTS, BY YEAR  
(thousands of pounds U<sub>3</sub>O<sub>8</sub>)

|                                            | 1981/1982 | 1983  | 1984  | 1985  | 1986  | 1987  | 1988  | 1989  | 1990  | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  |
|--------------------------------------------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| American Electric Power Co.                | 500       | 500   | 500   | 500   | 500   | 500   | 500   | 500   | 500   | —     | —     | —     | —     | —     | —     |
| Korea Electric Co.                         | —         | 500   | 500   | 500   | 500   | 500   | 500   | 500   | 500   | 500   | 500   | —     | —     | —     | —     |
| Federal Republic of Germany <sup>1</sup>   | 2,100     | 2,210 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 |
| JAURD <sup>2</sup>                         | 1,200     | 1,200 | 1,500 | 1,500 | 1,500 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Other Japanese Contracts <sup>3</sup>      | 1,760     | 600   | 600   | 600   | 800   | —     | —     | —     | —     | —     | —     | —     | —     | —     | —     |
| Repayment of loan to Australian Government | 1,000     | 1,000 | 228   | —     | —     | —     | —     | —     | —     | —     | —     | —     | —     | —     | —     |
| OKG                                        | 200       | 900   | 400   | 400   | 400   | 400   | 400   | 400   | 400   | 400   | 400   | 400   | 400   | 400   | 400   |
| Other Europe                               | 50        | 50    | 50    | 300   | 300   | 300   | 300   | 300   | 300   | 300   | 300   | 300   | 300   | —     | —     |
| Totals                                     | 6,810     | 6,990 | 6,578 | 6,600 | 6,800 | 6,500 | 6,500 | 6,500 | 6,500 | 6,000 | 6,000 | 5,500 | 5,500 | 5,200 | 5,200 |

<sup>1</sup>The three participants in ERA from the Federal Republic of Germany are UG Australia Development, Inter-uranium Australia, and Rheinische Braunkohlenwerke.

<sup>2</sup>Japan-Australia Uranium Resource Development Company (JAURD) is jointly held by Kansai Electric (50 percent), Kyushu Electric (25 percent), Shikoku Electric (15 percent) and C. Itoh and Company (10 percent).

<sup>3</sup>These contracts with Kyushu Electric and Chubu Electric were first signed in the early 1970's.

2. The fourth 1,000 MWe unit of the nuclear station Leningrad achieved criticality in December, 1980. In the first half of 1981 two more 1,000 MWe units (Kursk 3 and Tschernobyl 3) are scheduled for operation in the USSR.

3. The third 440 MWe nuclear unit at Kozloduj in Bulgaria also commenced operation in December 1980. The fourth unit will be in operation by the end of 1981. At that time, Bulgaria will have the highest percentage of electrical production from nuclear power in the Comecon group of countries.

By 1985 the USSR expects to more than triple its annual production of nuclear electricity, from 70 million megawatt-hours in 1980 to an estimated 220 million megawatt-hours in 1985. Installed capacity in 1985 is expected to be about 25,000 MWe.

# FAR EAST

From the inception of their nuclear power programs, Japan's utilities have been unique in their concern about security of uranium supply. Even among those nuclear nations lacking uranium resources, Japan has stood out in terms of tonnage under contract, number and diversity of sources, inventory size, and years of forward coverage. Now despite this situation, there are indications that a

number of Japanese utilities are having discussions with potential sellers about arrangements for uranium supply beginning in the late 1980's and extending into the late 1990's and beyond. It may be presumed that the current period of market weakness and oversupply is seen by the Japanese as presenting an usual opportunity to tie up additional tonnage. In keeping with the past practice, the potential suppliers represent African, Australian and Canadian sources.

Meanwhile in Korea, the economic slowdown has prompted a re-examination of load growth forecasts and that country's extremely ambitious nuclear program. As a consequence, a number of discussions concerning long term uranium supply have been put on hold as the Koreans review their nuclear program and associated uranium needs.

While they are similar to the Japanese in being totally dependent on imported uranium, the Koreans, unlike the Japanese, have shown themselves to be extremely price sensitive. In this they resemble US utilities, particularly in their resistance to price arrangements that could cause them to pay more than perceived market levels. It is now likely that further contracting by Korea will await better definition of future uranium needs.

## URANIUM MARKET

### UNITED STATES

Westinghouse Electric Corp. and Gulf Oil Corp. announced a settlement to their antitrust litigation. Under the settlement Gulf will pay Westinghouse \$25 million, and Gulf will provide or deliver some 13 million pounds  $U_3O_8$  to six Westinghouse utility customers. A summary of Westinghouse settlements with its uranium customers was presented in Nuexco Report 141.

It was announced that uranium mineralization has been discovered in northwest Nebraska. Wyoming Fuel Company owns a 50 percent interest in the prospect, now called Crow Butte, and Ferret Exploration Company owns the remaining 50 percent. Geologists at Crow Butte estimate potential reserves at more than 25 million pounds  $U_3O_8$ , making it one of the largest discoveries in the US in recent years. Test drillings indicate a uranium oxide content of about 0.1 percent. Much of the mineralization is shallow enough to be surface mined and the rest could probably be mined using solution mining techniques.

### TRANSACTIONS

Four material sales are reported this month. The largest involves the sale announced by Energy Resources of Australia (ERA) to Oskarshamnsverkets Kraftgrupp Aktiebolag (OKG) of 6.3 million pounds  $U_3O_8$  for delivery from 1982 through 1996 (see *Australia* section).

Also a long term sale of between one and three million pounds  $U_3O_8$  was completed from a Canadian producer to a European utility. A spot sale of less than 50 thousand pounds  $U_3O_8$  was made from a US producer to another US producer. Finally a US nuclear contractor sold a quantity between 300 thousand and 600 thousand pounds  $U_3O_8$  to a US producer.

One sale of conversion services on the secondary market is reported this month. A US nuclear contractor sold conversion services to a US utility.

### PRICING

The Exchange Value decreased to \$25.00 per pound  $U_3O_8$  from \$27.00 last month. As discussed in Nuexco Report 149, a gap had opened between sellers' offers and buyers' bids, with the latter at the \$25 level. In January, several sellers reduced prices in

order to close transactions. One transaction was in fact closed at the level of this month's Exchange Value and others are under discussion. Since large amounts of material are involved in these discussions, it is clear that the leading edge of prices has dropped considerably since the previous month.

Material available for spot and near term sale, as listed in the *Market Opportunities* section of this Report, totals 8.2 million pounds  $U_3O_8$  equivalent. This far outweighs the total of 710,000 pounds  $U_3O_8$  in inquiries to purchase on the spot and near term market. However a \$25 Exchange Value has often been mentioned as a reference level at which several US producers have indicated they would come into the market to make additional purchases. Now that the Exchange Value has come down to that level, additional demand may be forthcoming.

### CONVERSION

Beginning with this issue, Nuexco will publish a market value for the sale of conversion services. The Conversion Value is Nuexco's judgment as to the price at which transactions for conversion services in the spot and near term market could be concluded as of the end of the month.

While previous Nuexco Reports (e.g. Reports 138 and 143) have identified and followed this growing market, the increase in both opportunities and completed spot conversion transactions over the past 18 months points to the importance of a monthly commercial value for conversion services.

Measured as a percentage of near term Material Available for Sale in the *Market Opportunities* section of the Nuexco Report,  $UF_6$  has increased from six percent of the total in May 1979 to 36 percent in December 1980, reaching a high of 53 percent in September 1980. As a percentage of total near term Material Available for Loan opportunities,  $UF_6$  has maintained an average of about 50 percent over the past two years.

Despite the many offerings to sell and lend, however,  $UF_6$  has not in fact moved well in the market.  $U_3O_8$  is the preferred commodity in today's market and this corresponds to the rising demand for "deconversion" services—exchanging  $UF_6$  for the more marketable concentrates.

The emergence of this market is an indirect result of the enormous uranium stockpiles which users have

## URANIUM MARKET

accumulated because of delayed reactor start-up dates. The stockpiles are most often in the form of  $UF_6$ . With concentrates the more salable today (most utilities already have conversion contracts), a holder of  $UF_6$  wishing to sell from a stockpile often must "deconvert" its material to find a buyer.

The delay in reactor start-ups has also meant that some utilities possess long term conversion contracts that they do not currently need. Certain of these utilities are willing to offer their contracted conversion services for sale at a price below that of the primary market.

However the most common transaction in the secondary market for conversion services is the swap, wherein  $UF_6$  is exchanged for an equivalent quantity of concentrates, plus cash or additional concentrates as payment for the conversion services. This framework is useful for the inventory holder wishing to deconvert holdings from  $UF_6$  to concentrates.

Transactions of this type have been structured as follows:

1. The seller of the conversion services (seller) instructs its conversion contractor (converter) to make  $UF_6$  deliveries as required by the buyer of the conversion services (buyer).

2. The buyer delivers an equivalent amount of concentrates to the seller's account at a location specified by the seller.

3. After completion of the swap, the seller invoices the buyer for the agreed conversion price, or an additional quantity of concentrates is delivered in lieu of a cash payment.

The conversion price is the payment for receiving the upgraded material.

In the case of a utility wishing to sell excess conversion services, the transaction would involve a partial or complete assignment of the conversion contract. Thus structured, utility A would "sub-contract" its conversion services to utility B, i.e. utility B would convert its  $U_3O_8$  by means of utility A's contract. A contract between utility A and utility B would be constructed so that utility A would act as the "converter", receiving  $U_3O_8$  from utility B and delivering  $UF_6$  by way of its own conversion contract.

Although opportunities for conversion services in the secondary market have been limited to the short term, the possibility of long term opportunities is beginning to be considered. While more complicated in design, the longer term "sub-contracting" structure may be an alternative for a utility whose conversion services obligation stretches for many years without a corresponding need.

The price of near term conversion services in the secondary market will be determined to a large extent by the pressure to sell stockpiled  $UF_6$ . For a utility lacking a conversion contract, this opening of a secondary market may provide a less expensive means of converting its material. The growing significance of this market points to the importance of setting a regular commercial value on these conversion services.

Therefore beginning this month Nuexco will publish a monthly Conversion Value for spot and near term conversion sales. This month's Conversion Value is \$1.20 per pound U as  $UF_6$ . The definition and derivation of the Conversion Value are found in the *Statistical Data Section* of this Report.



COMMENTARY

**GOVERNMENT AND THE US  
URANIUM INDUSTRY**

In recent months, much discussion has revolved around actions which the US government might take to aid the domestic uranium industry. The problem is that more than 40 million pounds  $U_3O_8$  were produced in the US 1980, and less than 17 million pounds actually consumed. Furthermore, only a few new plants are being licensed per year, and annual consumption from new starts is building at a rate of less than two million pounds  $U_3O_8$  per year. US consumption will not reach 1980 production rates for more than ten years. Short term solutions to the industry's problems are therefore needed. Even accelerated completion of plants under construction, desirable as that may be, will not solve the US industry's problems within the next few years.

Inventories are important. US utilities hold approximately 120 million pounds  $U_3O_8$  equivalent in inventory. US government stockpiles are approximately 135 million pounds  $U_3O_8$  equivalent. The combined industry and government inventories are adequate to supply all US plants operating today for more than ten years without another pound being mined or imported.

When the US situation is viewed separately, it is clear that the future of the US supplier industry is bleak if it is limited to serving only the US where production already exceeds actual demand, and inventories are ample and growing. The driving force supporting the US industry today is existing contracts, and many of these contracts are approaching termination within a few years. In the absence of an unconventional solution, supply and demand will eventually be forced back into balance by declining price.

The obvious need is for the US industry to export. Success in exporting requires taking advantage of whatever strengths the US can muster while compensating for the disadvantage of low grade ore. What measures can the US government take in other areas to compensate for high cost production?

At present the US Export-Import Bank finances uranium as part of a sale of a nuclear steam supply system. Uranium opportunities not associated with equipment sales are, of course, available and would benefit from Export-Import Bank support. Separate reloads which may not presently qualify for Export-Import Bank financing could be included for favor-

able treatment by a change in government policy. The effect should be to help encourage US purchases even when nuclear systems are purchased from non-US suppliers.

A second, admittedly complex, suggestion would require a major government initiative. The US government owns a strategic stockpile of about 135 million pounds  $U_3O_8$  equivalent. It is, *in reality*, holding that stockpile for the benefit of other free world nations as well as the US. The US government would not likely fail to act if friends were forced by uranium shortages to discontinue nuclear electric power operations.

Security of nations lacking domestic production and enrichment capability could be enhanced by national stockpiles within national boundaries. Japan, for example, could benefit by an enriched  $UF_6$  inventory held *within* Japan. As Japan has the capability to fabricate finished fuel from enriched  $UF_6$ , an enriched  $UF_6$  stockpile would allow self-sufficiency on the entire front-end for a time. A case can be made, consequently, that non-US uranium users should assist in financing the free world's stockpile. In addition, the security of user nations could be enhanced at the same time.

This could be accomplished if the US government would endeavor to sell a major portion of its government enriched uranium stockpile to user nations, particularly Japan and the Federal Republic of Germany. Part of the understanding associated with the sale would be that the material would be held in those countries as a strategic stockpile. This is actually a variation of the "uranium bank" idea.

Material thus sold from the US stockpile could be replaced by US government purchases from domestic suppliers. The domestic purchase could be financed by revenue received from the overseas sales of enriched  $UF_6$ . Domestic demand of the order of five to ten million pounds per year for five years or more might result. This would help absorb some excess domestic production.

An obstacle to US uranium sales outside the US is the declining confidence in the soundness and consistency of US government nuclear policy. End use controls and uncertainty with regard to reliability of supply has removed the US in many cases as a favored source. Other supply sources are often favored to avoid US influence. Purchases from others, moreover,



## COMMENTARY

are sometimes made to *protest* US policy. These conditions are in clear need of change.

A final idea concerns favorable tax treatment of US uranium exports. Uranium exports do not presently qualify for preferred tax treatment under

Deferred Income Sales Corporations (DISC). As DISC's were established to promote US exports, the inclusion of uranium would be in the interests of both US government and industry. Such a change in the rules deserves serious consideration.

## RAW MATERIALS

### SOUTH TEXAS DISTRICT—PART I

#### Introduction

US uranium exploration and development activity during 1980 was estimated to be about 33 percent below the 1979 level. A decrease in activity was noted in every uranium district, except in South Texas where about 85 drill rigs operated continuously throughout the year—more than double the number operating in other districts. This high level activity resulted in new ore discoveries, the delineation of additional ore reserves, and the development of new production centers.

The growth of the district has progressed rapidly with the development of solution mining technology. Early prominence of the district was founded on open pit mining of shallow (to a depth of 150 feet) ore deposits in Karnes and Live Oak Counties beginning in the mid-1950's. Open pit mining in the two counties continues to contribute significantly to district activities. Simultaneous with the development of shallow ore deposits was the discovery of deeper ores which could not be recovered by conventional open pit or underground mining methods. The introduction of solution mining was a timely innovation for expanded development of the district.

In situ solution recovery tests were initiated in 1968 by Cities Service Corporation in southern Gonzales County and by Union Carbide Corporation at the Palangana salt dome in Duval County. The first tests met with partial success. Minor modification and adjustments in technology indicated that in situ solution mining of uranium was economically feasible. Further technological advances led to the first commercial scale in situ mining operation in Texas in 1975.

Uranium deposits amenable to in situ solution mining are characteristically low in uranium content, consist of poorly consolidated sandy sediments, natural ground water flow is consistent, and ore depth is beyond the economic limitations of open pit mining. The deeper South Texas deposits have all the favorable characteristics for in situ mining.

#### In Situ Solution Mining

In situ solution mining of uranium is accomplished by the circulation of chemical solutions (lixiviant) through an ore zone to dissolve the uranium minerals. The enriched solution is recovered for further processing. Ideally, the ore zone

should be overlain and underlain by a non-porous formation to help prevent loss of lixiviant to other formations. Solution movement is controlled by forced flow through properly spaced injection and recovery wells. Water pressure differential confines the lixiviant within the limits of the well pattern which usually includes four injection wells evenly spaced around one recover well. A production unit consists of multiple well patterns connected in the same controlled environment.

The lixiviant is prepared from on-site ground water with special chemicals added to cause dissolution of the uranium. The chemicals commonly used depend upon formational characteristics, ground water makeup, and certain environmental considerations. They consist of an anionic agent such as bicarbonate/carbonate, plus the addition of a strong oxidant to create soluble uranium, which, in turn, gradually enriches the lixiviant. The most widely used carbonates are ammonium carbonate and sodium carbonate; hydrogen peroxide and pure oxygen are the only oxidants used. A high volume of pure oxygen dissolved into the lixiviant stream is rapidly gaining acceptance as an efficient recovery technique. The effective use of chemical reagents diminishes as the depth of leaching action increases. The carbonates can gradually be replaced by an increasing amount of dissolved oxygen. Overall chemistry of the leaching process improves as depth and formation pressure increase.

The uranium-rich solution is pumped to the surface and the uranium is collected on resin beads upon passing through an ion exchange system. The barren lixiviant is again prepared chemically for reinjection into the leach field. The loaded resin is then passed through an elution column where the uranium is stripped out and transferred as slurry to the precipitation circuit. The uranium-rich slurry is passed through a thickener and finally a centrifuge to increase the uranium content to about 60 percent  $U_3O_8$ . After precipitation, the material is either dried and packaged at the site or it is shipped as a slurry concentrate to the Kerr-McGee conversion plant in Sequoyah County, Oklahoma.

There are potential advantages to in situ solution mining over conventional mining and milling methods. In situ leaching allows for the recovery of lower grade mineralization, minimizes environmental impact, can proceed at lower capital costs and reduced

## RAW MATERIALS

manpower requirements. A potential disadvantage is related to ground water clean-up at the end of the leach cycle. Industry experience with the clean-up process is limited to only a few case histories. Thus far, the cleanup process has proved to be difficult and new technology is under development. The use of smaller amounts of chemical reagent and more oxygen in the lixiviant is considered advantageous to the final clean-up process. Figure 1 is an aerial view of an in situ leach recovery plant in Duval County, Texas.

### Development History

Uranium mineralization in the South Texas district occurs in Eocene-Miocene strata of Tertiary age. The original discovery was made along the flanks of Todilla Hill in Karnes County during 1954. By mid-1958, about 200 uranium occurrences had been reported in the new district. Subsequent prospecting has led to discoveries throughout the trend of the Tertiary sequence from Fayette County south to the Rio Grande.

The first sustained mining operation was initiated by Susquehanna Western, Inc. (SWI) at Deweesville, Karnes County in 1960, followed by the construction of a 200 ton per day acid leach mill in 1961. The initial ore to be processed had been mined by Climax Molybdenum Company and stockpiled by the US Atomic Energy Commission in 1958. The last of the stockpiled ore was blended and processed with the first ores mined by SWI from shallow open pit mines in Karnes County. By 1964, SWI was mining along the ore trend in Live Oak County.

Until 1963, all known ore deposits around the Todilla Hill area contained oxidized ore. SWI discovered an unoxidized deposit at a depth of 130 feet about that time. The discovery was a significant milestone for the district. It broadened exploration potential to greater depths throughout the trend and almost all subsequent discoveries have occurred in the deeper environment. The unoxidized deposits proved to be much larger than the oxidized deposits and SWI expanded its total mining rate to 400 tons per day in 1965. Mill capacity was increased a like amount at the same time. SWI operated at the expanded rate until early 1973 when all mining and milling was terminated.

The tempo of activity began to increase throughout the district in 1967-68. The Atomic Energy Commission reported 6.4 million feet of drilling in

1969 compared to 3.3 million feet in 1968. Ore reserves were estimated at 3.8 million tons averaging 0.18 percent  $U_3O_8$ , or about 13,680,000 pounds  $U_3O_8$ . SWI production in 1968 was 1.2 million pounds  $U_3O_8$ .

SWI was the only company mining uranium in the district until 1969. Tenneco began mining at that time on the extension of a deposit being mined by SWI. Tenneco was one of the first of about 25 companies to undertake exploration in the district during the 1965-69 period. SWI built a 400 ton per day carbonate mill at Ray Point in 1970 to process the Felder ore mined by Exxon. That mill was shut down in 1973 for economic reasons.

The Conoco/Pioneer Nuclear joint venture, known as the Conquista project, began exploring throughout the Karnes County area in 1968. The program was successful and the venture began operating its newly constructed 1,750 ton per day mine and acid leach mill at Deweesville in 1972. The mill was expanded to 3,500 tons per day in 1979. According to a recent announcement by the venture partners, the project mining and milling rate will be cut back to approximately 1,700 tons ore per day beginning January 1981. An additional 400 tons ore per day mined by Exxon from the Felder deposit is to be toll milled at the Conquista plant. Chevron (Standard Oil of California) was the last to develop a conventional open pit and acid leach mill in the district. Chevron began operating a 3,000 ton per day mine and mill at its Panamaria property near Hobson in eastern Karnes County in 1979.

### District Geology

Uranium deposits of the South Texas district occur in Tertiary sediments which outcrop in a trend closely paralleling the shoreline of the Gulf of Mexico. The trend of mineralization extends to the southwest about 400 miles from Fayette County to Starr County on the US/Mexico border. (The mineral trend is known to continue another 100 miles into Mexico.) Figure 2 shows the stratigraphic relationship of the ore-bearing formations. Figure 3 shows the outcrop pattern of the Tertiary formations throughout the mineral trend. The principal areas of interest are within Karnes, Live Oak and Duval counties. Important uranium mineralization has been found in eight stratigraphic units of late Eocene to Pliocene age.

RAW MATERIALS

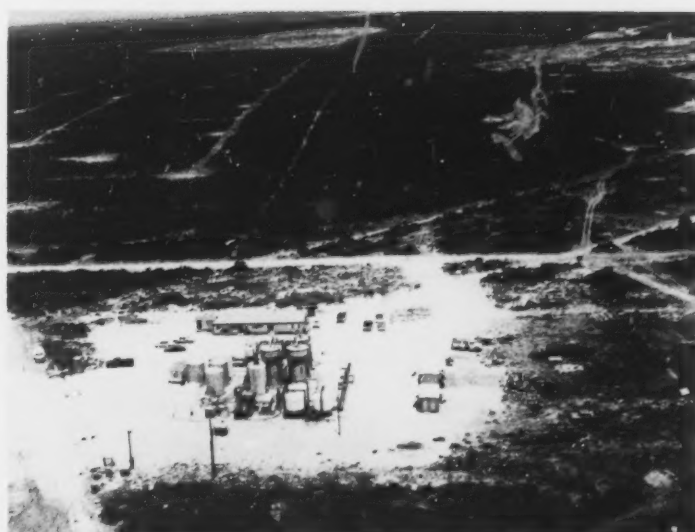


**Figure 1**  
**AERIAL VIEW OF URANIUM RESOURCES INC. 1200-GALLON-PER-MINUTE IN SITU SOLUTION PLANT AT BENAVIDES, DUVAL COUNTY, TEXAS.**

| Geologic Age | Geologic Unit          | Description                                          |
|--------------|------------------------|------------------------------------------------------|
| Holocene     | Flood-plain alluvium   | Sand, gravel, silt, clay                             |
|              | Terrace deposits       | Sand, gravel, silt, clay                             |
| Pleistocene  | Deweyville/Beaumont    | Sand, gravel, silt, clay                             |
| Pliocene     | Goliad Sandstone       | ■ Ore—fine to coarse sand & conglomerate, clay       |
| Miocene      | Fleming Formation      | Calcareous clay & sand                               |
|              | Oakville sandstone     | ■ Ore—Calcareous, coarse sand, lower portion favored |
| Oligocene    | Chusa tuff             | Calcareous tuff, clay gravel near base               |
|              | Soledad conglomerate   | ■ Ore Soledad—in Duval Co. grades to sand northward  |
|              | Fant tuff              | □ Ore—Lower portion                                  |
|              | Frio Clay              | □ Ore—Gray to green clay, lower portion—sandy        |
| Eocene       | Fashing clay           | Clay, lignite, sand                                  |
|              | Tordilla sandstone     | ■ Ore—fine sand                                      |
|              | Dubose                 | Sand, clay, lignite, silt                            |
|              | Deweessville sandstone | ■ Ore—fine sand, silt, clay                          |
|              | Conquista clay         | Carbonaceous clay                                    |
|              | Dillworth sandstone    | □ Ore—fine sand                                      |

**Figure 2**  
**STRATIGRAPHIC SECTION OF THE URANIUM-BEARING TERTIARY SEQUENCE, SOUTH TEXAS URANIUM PROVINCE. URANIUM-BEARING UNITS ARE NOTED:**  
■ = MAJOR URANIUM SOURCE; □ = MINOR URANIUM SOURCE

## RAW MATERIALS

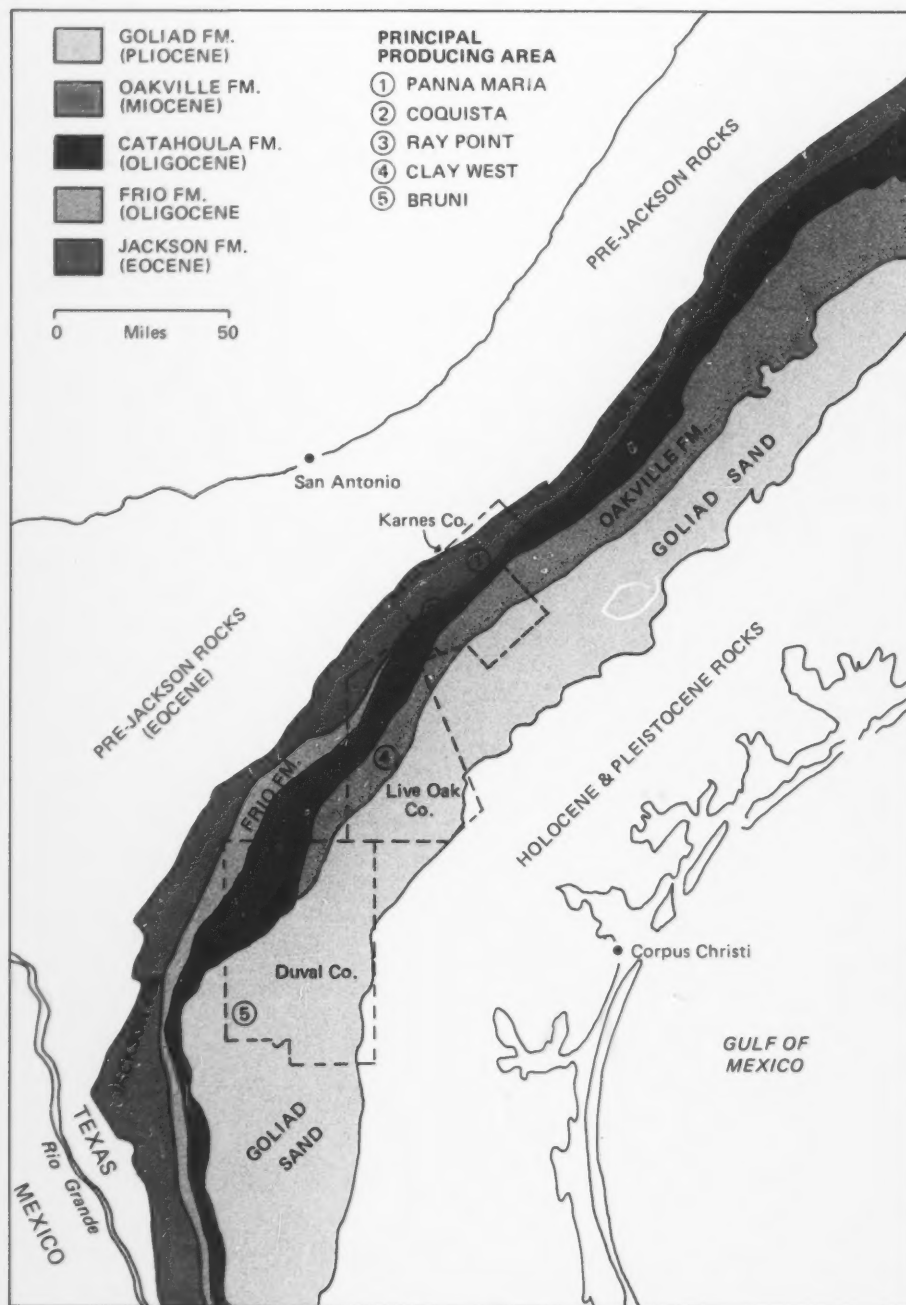


Figure 3  
GEOLOGIC MAP OF THE SOUTH TEXAS URANIUM DISTRICT SHOWING TREND OF URANIUM-TERTIARY FORMATIONS AND PRINCIPAL URANIUM PRODUCING AREAS.

## RAW MATERIALS

Evidence of structural activity throughout the district is limited to a one degree dip of the beds toward the Gulf Coast and faulting which tends to parallel the strike of the Tertiary formations. Faulting is more prominent in the northeast portion of the trend. Uranium host formations show zero to 40 feet of displacement along faults. The faulting has acted to control the placement of ore in certain areas. Such structural controls are prominent along the Oakville trend in Live Oak County where several ore deposits occur within graben structures. Occasionally ore is found adjacent to a fault plane which served to

restrict the flow of uranium-rich solutions and thereby contributed to the placement of an ore deposit. Such uranium occurrences adjacent to faulting were subjected to the continual migration and leaching action by ground water, resulting in some cases, to the redistribution and reprecipitation of the uranium. Age dating of ores from certain oxidized deposits suggests that the age of the ore varies from 15,000 to 25,000 years to more than 250,000 years. In fact, the process of leaching, migration and redeposition of uranium is considered a continuing process even in today's weathering environment.



STATISTICAL DATA

**EXCHANGE VALUE—\$25.00/lb U<sub>3</sub>O<sub>8</sub>**  
Determined as of January 31, 1981

**Definition**

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

- A. Data from recently completed transactions.
- B. Data from pending transactions.
- C. Firm bids to buy and firm offers to sell.
- D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

- A. The price of uranium delivered or to be delivered under old contracts.
- B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

| TRANSACTION VALUE                   |                    |                        |                  |
|-------------------------------------|--------------------|------------------------|------------------|
| Determined as of January 31, 1981   |                    |                        |                  |
| \$/lb U <sub>3</sub> O <sub>8</sub> | Millions of Pounds | Number of Transactions | Number of Months |
| 27.20                               | 3.1                | 10                     | 4                |

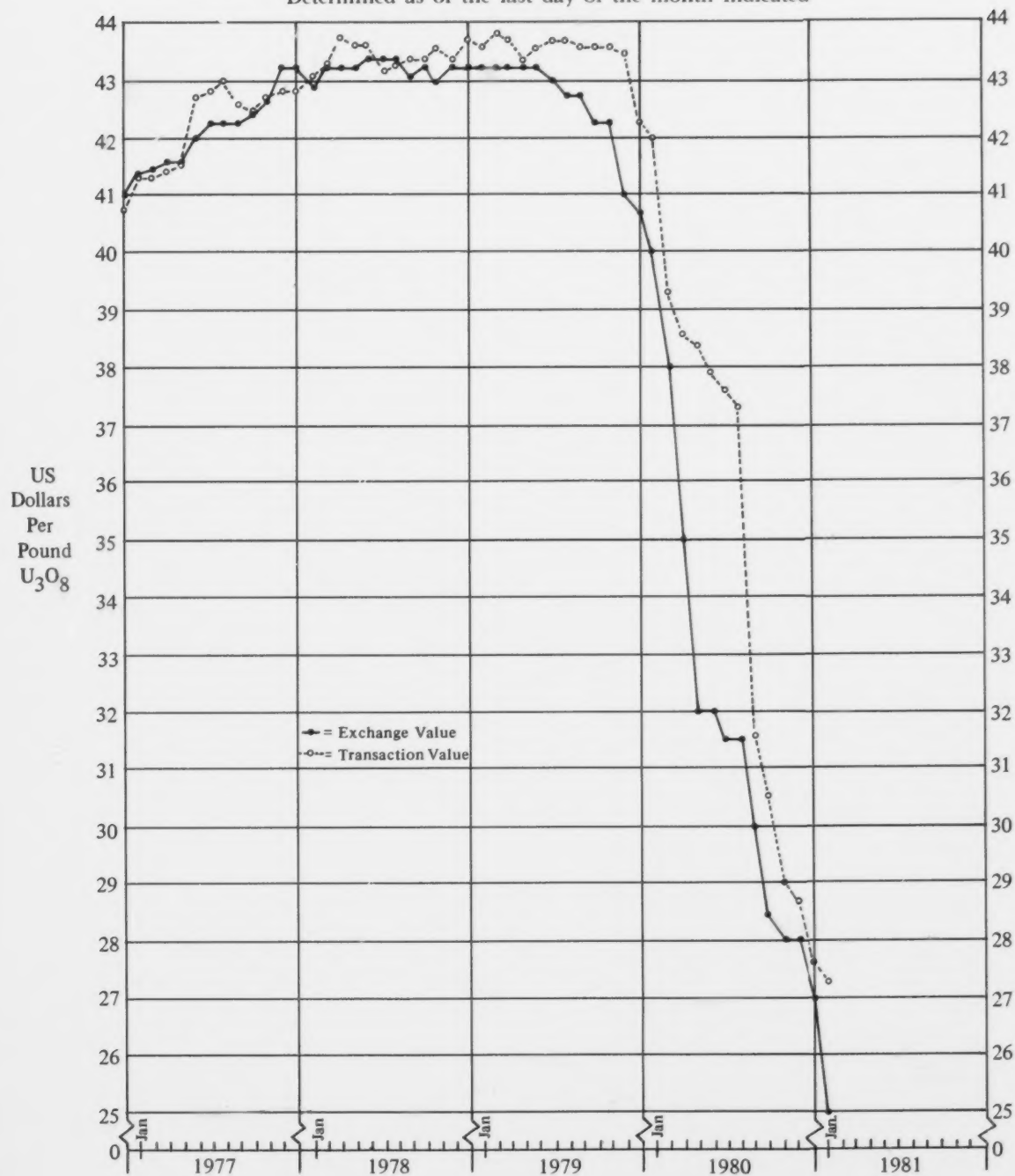
**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U<sub>3</sub>O<sub>8</sub> in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds U<sub>3</sub>O<sub>8</sub> are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

STATISTICAL DATA

EXCHANGE AND TRANSACTION VALUES  
SINCE JANUARY 1977

Determined as of the last day of the month indicated



## STATISTICAL DATA

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U<sub>3</sub>O<sub>8</sub>)

|      | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1968 | —     | —     | —     | —     | —     | —     | —     | 6.35  | 6.35  | 6.40  | 6.45  | 6.50  |
| 1969 | —     | 6.35  | 6.10  | 6.10  | 6.25  | 6.25  | 6.20  | 6.20  | 6.15  | 6.15  | 6.15  | 6.20  |
| 1970 | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.20  | 6.15  | 6.15  | 6.15  | 6.15  |
| 1971 | 6.20  | 6.20  | 6.20  | 6.20  | 6.15  | 6.05  | 6.00  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  |
| 1972 | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  |
| 1973 | 5.95  | 6.00  | 6.10  | 6.20  | 6.45  | 6.50  | 6.50  | 6.50  | 6.50  | 6.50  | 6.75  | 7.00  |
| 1974 | 7.70  | 7.90  | 8.00  | 9.00  | 9.50  | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 |       |       |       |       |       |       |       |       |       |       |       |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U<sub>3</sub>O<sub>8</sub>)

|      | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1976 | —     | —     | —     | —     | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 |       |       |       |       |       |       |       |       |       |       |       |

EXCHANGE VALUE EXPRESSED IN SELECTED  
PRODUCER & CONSUMER CURRENCIES\*

| Country             | per lb U <sub>3</sub> O <sub>8</sub><br>in Concentrates | per kg U <sub>3</sub> O <sub>8</sub><br>in Concentrates | per kg U<br>in Concentrates |
|---------------------|---------------------------------------------------------|---------------------------------------------------------|-----------------------------|
| US (dollar)         | 25.00                                                   | 55.12                                                   | 64.99                       |
| France (franc)      | 120.71                                                  | 266.13                                                  | 313.83                      |
| FRG (mark)          | 52.42                                                   | 115.57                                                  | 136.29                      |
| Japan (yen)         | 5,111                                                   | 11,269                                                  | 13,289                      |
| Switzerland (franc) | 47.60                                                   | 104.94                                                  | 123.75                      |
| UK (pound)          | 10.42                                                   | 22.97                                                   | 27.09                       |
| Australia (dollar)  | 21.31                                                   | 46.99                                                   | 55.41                       |
| Canada (dollar)     | 29.89                                                   | 65.90                                                   | 77.72                       |
| Niger, Gabon (CFA)  | 6,036                                                   | 13,306                                                  | 15,692                      |
| South Africa (rand) | 18.87                                                   | 41.60                                                   | 49.05                       |

\*Calculated using currency exchange rates published in the Wall Street Journal on the last business day of the month.

**STATISTICAL DATA**

**LOAN USE CHARGE RATE—7.0%/year**

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

- A. Data from recently completed or pending loan transactions.
- B. Rates included in firm proposals to borrow or lend.

C. Rates that potential borrowers and lenders have expressed a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

**CONVERSION VALUE—\$1.20/lb. U as UF<sub>6</sub>**  
Determined as of January 31, 1981

**Definition**

The Conversion Value is Nuexco's judgment of the price at which transactions for significant quantities of conversion services could be concluded on the spot and/or near term market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

- A. Data from recently completed transactions.
- B. Data from pending transactions.
- C. Firm bids to buy and firm offers to sell.

D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

- A. The price of conversion services delivered or to be delivered under old contracts.
- B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

## STATISTICAL DATA

## CURRENT TRANSACTIONS\*

| Nuexco Reference Number        | Delivery Period | Approximate Quantity (thousands of pounds, U3Os equivalent) | Approximate Price as percent of Current E.V. | Seller Group | Buyer Group | Remarks                                    |
|--------------------------------|-----------------|-------------------------------------------------------------|----------------------------------------------|--------------|-------------|--------------------------------------------|
| <b>Uranium Transactions</b>    |                 |                                                             |                                              |              |             |                                            |
| 1353                           | 83-95           | 1001 - 3000                                                 | —                                            | Canada       | Europe      | Price is market related                    |
| 1376                           | 81              | 301 - 600                                                   | 100                                          | US           | US          |                                            |
| 1383                           | 81              | Less than 50                                                | 105                                          | US           | US          |                                            |
| 1386                           | 82-96           | 4001 - 7000                                                 | —                                            | Australia    | Europe      | Definitive price information not available |
| <b>Conversion Transactions</b> |                 |                                                             |                                              |              |             |                                            |
| 1385                           | 81              | 601 - 1000                                                  | 92                                           | US           | US          | Price is percent of Conversion Value       |

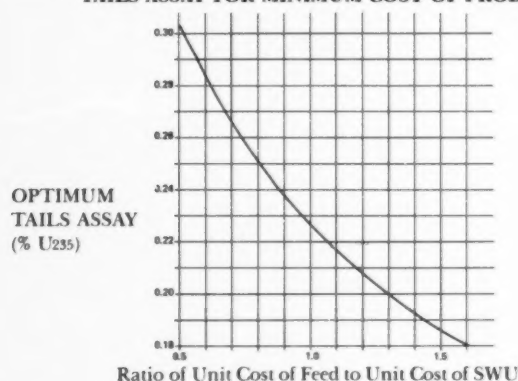
\*Transactions listed include not only those in which Nuexco was involved, but also all others of which Nuexco is aware.

STATISTICAL DATA

OPTIMUM TAILS ASSAY

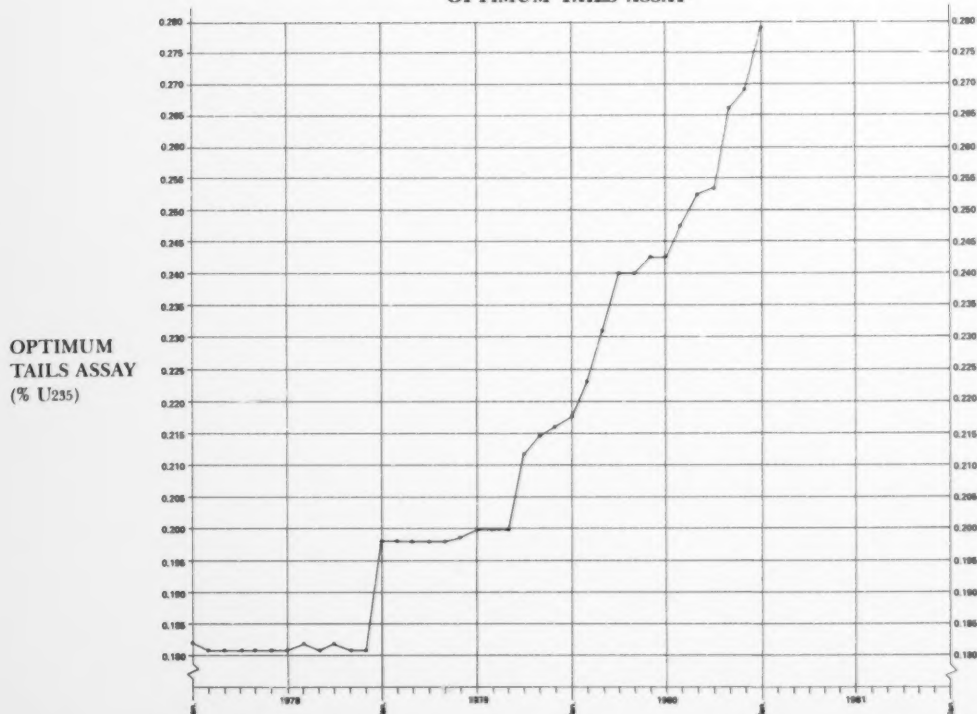
The optimum tails assay is the tails composition at which the cost of enriched uranium is lowest for given costs of separative work (SWU) and natural uranium feed. It depends only on the ratio of the cost of a kilogram of natural uranium in the form of  $UF_6$  to the cost of a kilogram unit of separative work. The US Department of Energy (USDOE) Adjustable Fixed Commitment (AFC) enrichment contract holders have the option, within limits, to specify the transaction tails assay. The transaction tails assay for USDOE Requirements contracts is 0.2 percent  $U_{235}$ . For every one-hundredth of one percent increase in the transaction tails assay, uranium consumption increases about two percent.

TAILS ASSAY FOR MINIMUM COST OF PRODUCT\*



\*From Nuexco Report 138

OPTIMUM TAILS ASSAY<sup>1</sup>



<sup>1</sup>Based on Exchange Value and USDOE AFC SWU price; interpolated to the nearest thousandth.



## STATISTICAL DATA

## US GOVERNMENT STATISTICS

|                                 | Producer Price<br>Index—Industrial<br>Commodities<br>(1967 = 100) <sup>1</sup> | Consumer<br>Price<br>Index<br>(1967 = 100) <sup>2</sup> | GNP<br>Implicit<br>Price<br>Deflator<br>(1972 = 100) <sup>3</sup> | Gross Average Hourly Earnings<br>of Production or Non-supervisory<br>Workers (US\$) <sup>4</sup> |                                               |                                                 |
|---------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------|
|                                 |                                                                                |                                                         |                                                                   | Metal<br>Mining<br>(SIC 10)                                                                      | Primary<br>Non-ferrous<br>Metals<br>(SIC 333) | Chemicals<br>and Allied<br>Products<br>(SIC 28) |
| Annual Avg. 1970 <sup>(5)</sup> | 110.0                                                                          | 116.3                                                   | 91.36                                                             | 3.88                                                                                             | 3.87                                          | 3.69                                            |
| Annual Avg. 1971 <sup>(5)</sup> | 114.1                                                                          | 121.3                                                   | 96.02                                                             | 4.12                                                                                             | 4.15                                          | 3.97                                            |
| Annual Avg. 1972 <sup>(5)</sup> | 117.9                                                                          | 125.3                                                   | 100.00                                                            | 4.56                                                                                             | 4.59                                          | 4.26                                            |
| Annual Avg. 1973 <sup>(5)</sup> | 125.9                                                                          | 133.1                                                   | 105.80                                                            | 4.84                                                                                             | 4.98                                          | 4.51                                            |
| Annual Avg. 1974 <sup>(5)</sup> | 153.8                                                                          | 147.7                                                   | 116.02                                                            | 5.44                                                                                             | 5.63                                          | 4.88                                            |
| Annual Avg. 1975 <sup>(5)</sup> | 171.5                                                                          | 161.2                                                   | 127.15                                                            | 6.13                                                                                             | 6.24                                          | 5.39                                            |
| Annual Avg. 1976 <sup>(5)</sup> | 182.4                                                                          | 170.5                                                   | 133.71                                                            | 6.76                                                                                             | 6.87                                          | 5.91                                            |
| Annual Avg. 1977 <sup>(6)</sup> | 195.1                                                                          | 181.5                                                   | 141.70                                                            | 7.28                                                                                             | 7.67                                          | 6.43                                            |
| Annual Avg. 1978 <sup>(6)</sup> | 209.4                                                                          | 195.4                                                   | 152.05                                                            | 8.23                                                                                             | 8.56                                          | 7.02                                            |
| Annual Avg. 1979 <sup>(6)</sup> | 236.5                                                                          | 217.4                                                   | 165.46                                                            | 9.27                                                                                             | 9.49                                          | 7.60                                            |
| Oct 1979                        | 249.0                                                                          | 225.4                                                   | —                                                                 | 9.67                                                                                             | 9.87                                          | 7.83                                            |
| Nov 1979                        | 250.6                                                                          | 227.5                                                   | —                                                                 | 9.78                                                                                             | 9.85                                          | 7.88                                            |
| Dec 1979                        | 253.1                                                                          | 229.9                                                   | 170.58                                                            | 9.80                                                                                             | 9.92                                          | 7.92                                            |
| Jan 1980                        | 260.6                                                                          | 233.2                                                   | —                                                                 | 9.91                                                                                             | 10.06                                         | 7.97                                            |
| Feb 1980                        | 265.9                                                                          | 236.4                                                   | —                                                                 | 9.92                                                                                             | 10.01                                         | 8.01                                            |
| Mar 1980                        | 268.6                                                                          | 239.8                                                   | 174.48                                                            | 9.90                                                                                             | 10.22                                         | 8.05                                            |
| Apr 1980                        | 271.3                                                                          | 242.5                                                   | —                                                                 | 10.00                                                                                            | 10.30                                         | 8.12                                            |
| May 1980                        | 271.9R                                                                         | 244.9                                                   | —                                                                 | 10.18                                                                                            | 10.37                                         | 8.17                                            |
| Jun 1980                        | 273.5R                                                                         | 247.6                                                   | 178.93                                                            | 10.13                                                                                            | 10.69                                         | 8.24                                            |
| Jul 1980                        | 276.2                                                                          | 247.8                                                   | —                                                                 | 10.24                                                                                            | 10.82                                         | 8.35                                            |
| Aug 1980                        | 278.2R                                                                         | 249.4                                                   | —                                                                 | 10.38                                                                                            | 10.78                                         | 8.39                                            |
| Sep 1980                        | 278.2P                                                                         | 251.7                                                   | 182.92                                                            | 10.54                                                                                            | 10.94                                         | 8.46                                            |
| Oct 1980                        | 281.2P                                                                         | 253.9                                                   | —                                                                 | 10.58                                                                                            | 11.00                                         | 8.52                                            |
| Nov 1980                        | 282.7P                                                                         | 256.2                                                   | —                                                                 | 10.65P                                                                                           | 11.09P                                        | 8.57P                                           |
| Dec 1980                        | 286.1P                                                                         | 258.4                                                   | 183.98                                                            | —                                                                                                | —                                             | 8.64P                                           |

P = Preliminary R = Revised since last month

- (1) US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.
- (2) US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.
- (3) US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.
- (4) US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for January 1977 and beyond are adjusted to the March 1979 benchmark.
- (5) Data for 1970-1976, monthly except for the GNP Implicit Price Deflator, and Price Index data for 1977-1978 appear on pages 4.6-4.8 of Nuexco Report 139.
- (6) Employment and Earnings data for 1977-1979, monthly, appear on page 33 of Nuexco Report 147.

STATISTICAL DATA

AUSTRALIAN GOVERNMENT STATISTICS

|                                 | Price Index of Materials<br>Used in Manufacturing<br>Industry—All Groups<br>(Year 1968-69 = 100.0) <sup>1</sup> | Weighted Average<br>Minimum Weekly Wage<br>Rates—Adult Males<br>Australia<br>Mining and Quarrying (A\$) <sup>2</sup> |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Annual Avg. 1970 <sup>(3)</sup> | 101.4                                                                                                           | 59.88                                                                                                                |
| Annual Avg. 1971 <sup>(3)</sup> | 101.5                                                                                                           | 65.95                                                                                                                |
| Annual Avg. 1972 <sup>(3)</sup> | 105.6                                                                                                           | 71.26                                                                                                                |
| Annual Avg. 1973 <sup>(3)</sup> | 124.4                                                                                                           | 78.96                                                                                                                |
| Annual Avg. 1974 <sup>(3)</sup> | 141.9                                                                                                           | 108.07                                                                                                               |
| Annual Avg. 1975 <sup>(3)</sup> | 150.4                                                                                                           | 132.55                                                                                                               |
| Annual Avg. 1976 <sup>(3)</sup> | 168.4                                                                                                           | 160.93                                                                                                               |
| Annual Avg. 1977 <sup>(3)</sup> | 192.0                                                                                                           | 179.03                                                                                                               |
| Annual Avg. 1978 <sup>(3)</sup> | 215.4                                                                                                           | 190.04                                                                                                               |
| Annual Avg. 1979                | 248.5                                                                                                           | 196.34                                                                                                               |
| Aug 1979                        | 293.2                                                                                                           | 201.43                                                                                                               |
| Sep 1979                        | 302.4                                                                                                           | 202.24                                                                                                               |
| Oct 1979                        | 309.4                                                                                                           | 201.71R                                                                                                              |
| Nov 1979                        | 310.4                                                                                                           | 201.05                                                                                                               |
| Dec 1979                        | 319.4                                                                                                           | 201.85                                                                                                               |
| Jan 1980                        | 340.1                                                                                                           | 215.72R                                                                                                              |
| Feb 1980                        | 345.6                                                                                                           | 215.18                                                                                                               |
| Mar 1980                        | 340.3                                                                                                           | 214.81                                                                                                               |
| Apr 1980                        | 327.9                                                                                                           | 215.12                                                                                                               |
| May 1980                        | 335.1                                                                                                           | 214.79R                                                                                                              |
| Jun 1980                        | 338.4                                                                                                           | 214.12R                                                                                                              |
| Jul 1980                        | 349.1                                                                                                           | 221.41                                                                                                               |
| Aug 1980                        | 353.2                                                                                                           | 219.70                                                                                                               |
| Sep 1980                        | 351.6                                                                                                           | 219.16                                                                                                               |
| Oct 1980                        | 348.7P                                                                                                          | 219.37P                                                                                                              |
| Nov 1980                        | —                                                                                                               | 219.75P                                                                                                              |

P = Preliminary R = Revised since last month

(1) Australian Bureau of Statistics, Canberra; "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

(2) Australian Bureau of Statistics, Canberra; "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest fourteen months shown are subject to revision.

(3) Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

## STATISTICAL DATA

## CANADIAN GOVERNMENT STATISTICS

|                  | Industry Selling<br>Price Index:<br>Manufacturing<br>(D 500000) <sup>1,2</sup><br>(1971 = 100.0) | Wage-earner Data:<br>Average Hourly Earnings (C\$) <sup>3,4</sup> |                                                              |                                                        |
|------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------|
|                  |                                                                                                  | Metal Mining,<br>including<br>milling<br>(SIC 050-059)            | Primary Metal<br>Industries,<br>non-ferrous<br>(SIC 296-298) | Chemicals and<br>Chemical<br>Products<br>(SIC 370-379) |
| Annual Avg. 1977 | 174.3                                                                                            | 8.18                                                              | 6.50                                                         | 6.51                                                   |
| Annual Avg. 1978 | 190.4                                                                                            | 8.76                                                              | 6.82                                                         | 6.97                                                   |
| Annual Avg. 1979 | 217.9                                                                                            | 9.60                                                              | 7.35                                                         | 7.67                                                   |
| Sep 1979         | 223.4                                                                                            | 9.75                                                              | 7.50                                                         | 7.81                                                   |
| Oct 1979         | 227.4                                                                                            | 9.89                                                              | 7.54                                                         | 7.88                                                   |
| Nov 1979         | 228.1                                                                                            | 9.97                                                              | 7.61                                                         | 7.91                                                   |
| Dec 1979         | 230.4                                                                                            | 9.93                                                              | 7.51                                                         | 7.89                                                   |
| Jan 1980         | 239.0                                                                                            | 9.96                                                              | 7.57                                                         | 7.99                                                   |
| Feb 1980         | 240.8                                                                                            | 10.11                                                             | 7.69                                                         | 8.08                                                   |
| Mar 1980         | 239.5                                                                                            | 10.34                                                             | 7.83                                                         | 8.26                                                   |
| Apr 1980         | 241.1                                                                                            | 10.40                                                             | 7.94                                                         | 8.36                                                   |
| May 1980         | 242.4                                                                                            | 10.50                                                             | 8.01                                                         | 8.44                                                   |
| Jun 1980         | 243.7                                                                                            | 10.51                                                             | 8.07                                                         | 8.46                                                   |
| Jul 1980         | 246.3R                                                                                           | 10.49                                                             | 8.11                                                         | 8.55                                                   |
| Aug 1980         | 249.2R                                                                                           | 10.58                                                             | 8.14                                                         | 8.65                                                   |
| Sep 1980         | 251.7R                                                                                           | 10.76P                                                            | 8.24P                                                        | 8.71P                                                  |
| Oct 1980         | 255.1                                                                                            | 11.02P                                                            | 8.29P                                                        | 8.81P                                                  |
| Nov 1980         | 256.9P                                                                                           | —                                                                 | —                                                            | —                                                      |

P = Preliminary R = Revised since last month

(1) Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

(2) Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

(3) Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

(4) Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

STATISTICAL DATA

REPUBLIC OF SOUTH AFRICA STATISTICS

|                                 | Average Declared Working<br>Costs per Metric Ton of<br>Gold Ore Milled (Rand) <sup>1</sup> | Consumer<br>Price Index <sup>2</sup><br>(1975 = 100, except where<br>otherwise indicated) |
|---------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Annual Avg. 1970 <sup>(3)</sup> | 7.34                                                                                       | 100.3 <sup>(4)</sup>                                                                      |
| Annual Avg. 1971 <sup>(3)</sup> | 7.88                                                                                       | 106.4 <sup>(4)</sup>                                                                      |
| Annual Avg. 1972 <sup>(3)</sup> | 8.79                                                                                       | 113.3 <sup>(4)</sup>                                                                      |
| Annual Avg. 1973 <sup>(3)</sup> | 10.51                                                                                      | 124.1 <sup>(4)</sup>                                                                      |
| Annual Avg. 1974 <sup>(3)</sup> | 13.18                                                                                      | 138.5 <sup>(4)</sup>                                                                      |
| Annual Avg. 1975 <sup>(3)</sup> | 16.71                                                                                      | 157.2 <sup>(4)</sup>                                                                      |
| Annual Avg. 1976 <sup>(3)</sup> | 19.30                                                                                      | 174.7 <sup>(4)</sup>                                                                      |
| Annual Avg. 1977 <sup>(3)</sup> | 23.87                                                                                      | 194.4 <sup>(4)</sup>                                                                      |
| Annual Avg. 1978 <sup>(3)</sup> | 27.14                                                                                      | 137.2                                                                                     |
| Annual Avg. 1979 <sup>(3)</sup> | 30.18                                                                                      | 155.3                                                                                     |
| Oct 1979                        | —                                                                                          | 162.9                                                                                     |
| Nov 1979                        | —                                                                                          | 163.4                                                                                     |
| Dec 1979                        | 31.89                                                                                      | 164.0                                                                                     |
| Jan 1980                        | —                                                                                          | 165.4                                                                                     |
| Feb 1980                        | —                                                                                          | 167.0                                                                                     |
| Mar 1980                        | 33.65                                                                                      | 168.0                                                                                     |
| Apr 1980                        | —                                                                                          | 170.0                                                                                     |
| May 1980                        | —                                                                                          | 171.9                                                                                     |
| Jun 1980                        | 34.48                                                                                      | 174.6                                                                                     |
| Jul 1980                        | —                                                                                          | 177.2                                                                                     |
| Aug 1980                        | —                                                                                          | 179.2                                                                                     |
| Sep 1980                        | 36.19                                                                                      | 182.8                                                                                     |
| Oct 1980                        | —                                                                                          | 186.3                                                                                     |
| Nov 1980                        | —                                                                                          | 187.8                                                                                     |
| Dec 1980                        | —                                                                                          | 189.9                                                                                     |

(1) Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

(2) Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

(3) Historical data for 1970 through 1979 appear on page 4.9 of Nuexco Report 140.

(4) April 1970 = 100.00

## MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

## URANIUM SUPPLY

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U3O8) |              |              | Remarks                |
|-------------------------------|------------------------------------------------|--------------|--------------|------------------------|
|                               | 0 to 1 Year                                    | 1 to 2 Years | 2 to 3 Years |                        |
| Available for Sale:           |                                                |              |              |                        |
| 1392                          | 400                                            |              |              | Long term<br>UF6       |
| 1393                          | 60                                             | 175          | 175          |                        |
| 1475                          | 1000                                           |              |              |                        |
| 1480                          | 500                                            |              |              |                        |
| 1490                          | 1000                                           |              |              | UF6                    |
| 1533                          | 400                                            |              |              |                        |
| 1534                          | 350                                            |              |              |                        |
| 1540                          | 750                                            |              |              |                        |
| 1550                          | 1500                                           |              |              | Long term              |
| 1551                          | 200                                            |              |              |                        |
| 1552                          | 600                                            |              |              |                        |
| 1562                          |                                                | 150          | 150          |                        |
| 1576                          | 200                                            |              |              | Long term<br>Long term |
| 1581                          | 100                                            | 150          | 150          |                        |
| 1589                          | 140                                            | 300          | 300          |                        |
| 1595                          | 1000                                           |              |              |                        |
| 1600                          |                                                |              | 200          | Long term              |
| TOTALS                        | 8200                                           | 775          | 975          |                        |

## Available for Loan:

|              |             |  |  |                 |
|--------------|-------------|--|--|-----------------|
| 1429         | 500         |  |  |                 |
| 1492         | 900         |  |  | UF <sub>6</sub> |
| 1602         | 400         |  |  |                 |
| <b>TOTAL</b> | <b>1800</b> |  |  |                 |

\*Measured from the date of this Report.

**MARKET OPPORTUNITIES**

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

**URANIUM DEMAND**

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U3Os) |              |              | Remarks   |
|-------------------------------|------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                    | 1 to 2 Years | 2 to 3 Years |           |
| Inquiries to Purchase:        |                                                |              |              |           |
| 1459                          |                                                | 200          | 200          | Long term |
| 1462                          |                                                |              | 100          | Long term |
| 1513                          | 200                                            |              |              |           |
| 1514                          | 400                                            |              |              |           |
| 1529                          |                                                |              | 550          | Long term |
| 1582                          | 10                                             |              |              | UF6       |
| 1587                          |                                                | 275          | 275          | Long term |
| 1603                          | 100                                            | 100          |              | Long term |
| TOTALS                        | 710                                            | 575          | 1125         |           |

**Inquiries to Borrow:**

\*Measured from the date of this Report.



# MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the secondary market for UF<sub>6</sub> conversion services. The data presented in this section are in no way intended to be indicative of the entire market for the time period covered.

## CONVERSION SUPPLY

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U as UF <sub>6</sub> ) |              |              | Remarks |
|-------------------------------|-----------------------------------------------------------------|--------------|--------------|---------|
|                               | 0 to 1 Year                                                     | 1 to 2 Years | 2 to 3 Years |         |
| 1451                          | 75                                                              |              |              |         |
| 1475                          | 850                                                             |              |              |         |
| 1540                          | 650                                                             |              |              |         |
| 1584                          | 600                                                             | 200          | 200          |         |
| 1599                          | 800                                                             | 300          |              |         |
| TOTALS                        | 2975                                                            | 500          | 200          |         |

## CONVERSION DEMAND

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U as UF <sub>6</sub> ) |              |              | Remarks   |
|-------------------------------|-----------------------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                                     | 1 to 2 Years | 2 to 3 Years |           |
| 1492                          | 850                                                             |              |              |           |
| 1594                          | 400                                                             |              | 950          | Long term |
| 1596                          |                                                                 | 650          |              |           |
| TOTALS                        | 1250                                                            | 650          | 950          |           |

\*Measured from the date of this Report.

INDEX

URANIUM MARKET INDEX

| Topic                                             | Report Number |     |     |     |      |     |     |     |     |     |     |     |   |  |
|---------------------------------------------------|---------------|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|---|--|
|                                                   | 138           | 139 | 140 | 141 | 142  | 143 | 144 | 145 | 146 | 147 | 148 | 149 |   |  |
| Projected US & Free World Production              |               | 1.0 |     | 1.2 |      |     |     |     |     | 7   |     | 7   |   |  |
| Actual US & Free World Production                 | 1.5           |     |     | 1.5 |      |     | 5   |     |     | 12  |     |     |   |  |
| US Import-Export Balance                          |               |     |     |     | 6    | 4   |     |     |     | 11  |     |     |   |  |
| Apparent Future Consumption                       |               |     |     |     |      |     |     |     |     |     |     |     |   |  |
| Estimate                                          | 1.1           |     |     |     | 2, 4 |     | 2   |     |     | 2   |     | 7   |   |  |
| USDOE Forecast of Uranium Requirements            |               |     |     |     |      |     | 7   |     |     |     |     |     |   |  |
| Uranium Supply & Demand Balance                   |               |     |     |     | 1    |     |     | 1   | 9   | 10  |     | 9   |   |  |
| Projection of Installed Nuclear Electric Capacity |               |     | 1.2 | 1.7 |      |     | 3   |     |     | 4   |     |     |   |  |
| Past Nuclear Electric Power Generation            |               | 1.1 |     |     |      |     |     |     |     | 14  |     | 3   |   |  |
| Uranium Sales Summary                             |               | 1.2 |     |     |      |     |     |     |     | 17  |     |     |   |  |
| ERA Sales and Financial Data                      |               |     |     |     |      |     |     |     | 1   | 13  |     | 2   |   |  |
| USDOE Survey of US Production Potential           |               |     |     |     |      |     |     |     | 6   |     |     |     |   |  |
| New Mexico Severance Tax                          |               |     |     |     |      |     |     |     |     |     |     | 2   |   |  |
| 1980 Supply & Demand Summary                      |               |     |     |     |      |     |     |     |     |     |     | 3   |   |  |
| INFCE—Nuexco PWR Requirements                     |               |     |     |     |      |     |     |     |     |     |     |     | 1 |  |

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# NUEXCO

3000 SAND HILL ROAD  
MENLO PARK, CALIFORNIA 94025

## EXECUTIVE SUMMARY & INDUSTRY OVERVIEW NUEXCO REPORT 150

The **Exchange Value** declined to \$25.00 per pound U<sub>3</sub>O<sub>8</sub> from \$27.00 the previous month. At the beginning of January, there was a substantial difference, about two or three dollars per pound, between buyers' bids and sellers' offers. During the month, many sellers reduced prices in order to close transactions. One near term transaction did close at about this month's Exchange Value, and several others are under discussion at the same price levels.

The total of inquiries to sell in the spot and near term market was about eight million pounds U<sub>3</sub>O<sub>8</sub> equivalent, while inquiries to purchase in the same time frame were less than one million pounds. However several potential US buyers had previously indicated an interest in entering the market if prices declined to the \$25 level. Thus additional near term demand may be forthcoming.

The **Transaction Value** declined to \$27.20 per pound U<sub>3</sub>O<sub>8</sub> from \$27.70 the previous month. Two near term transactions closed this month involving US buyers and sellers. Also, a long term transaction was announced between Energy Resources of Australia and OKG of Sweden. Another long term contract was signed by a European buyer and a Canadian seller.

Beginning with this Report, Nuexco will publish a market price for spot and near term sales of conversion services. This new feature is in connection with the recent increase in conversion services available for sale in the secondary market, as well as recent transactions. The **Conversion Value** this month is \$1.20 per pound U as UFe.

Nuexco estimates that production by the major free world uranium producing countries increased to about 111 million pounds U<sub>3</sub>O<sub>8</sub> in 1980, a 14 percent increase over 1979. The major increases were in the US and South Africa. US production rose to 42.5 million pounds, from 37.6 million the year before. It had previously been expected that US production would drop in 1980. Production of nuclear electricity in the free world increased by about eight percent in 1980 although US output decreased slightly from the 1979 level.

This Report contains a review of 1980 uranium market activity. The *Commentary* section of this Report discusses action which the US government might consider to assist the domestic uranium industry. This month's *Raw Materials* essay covers the South Texas uranium district.

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MARCH 1981

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## Monthly Report on the Uranium Market

# NUEXCO

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# NUEXCO

## MONTHLY REPORT ON THE URANIUM MARKET

March 1981

No. 151

JAMES E. VAUGHAN, *EDITOR*

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## FOREWORD

There was a typographical error in Table 1 of last month's Report, Number 150. Production for France in 1980 should have been 6.6 million pounds  $U_3O_8$ , not 5.6 as indicated. The world total for 1980 of 110.8 million pounds  $U_3O_8$  was correct.

The definition of the Conversion Value has been reworded somewhat this month for better clarity.

## URANIUM MARKET

### GENERAL

#### Uranium Disputes

During its brief history and continuing to date, the commercial uranium industry has been beset by legal entanglements apparently unparalleled for an industry its size. A two-year grand jury investigation, a congressional investigation and a veritable blizzard of litigation have taxed the human and financial resources of buyers and sellers alike.

Because of several new suits and the changing identity of litigants in existing suits, Nuexco has summarized the status of ongoing uranium litigation below. This review is limited to publicly available information and describes the identity of the litigants, the issues in contention and the current status.

#### *Richmond Case (Westinghouse)*

This case was initiated in late 1975 and involved a multi-district proceeding in the US District Court in Richmond, Virginia, a state court proceeding in Pennsylvania and a Swedish case. Plaintiffs are 17 US and three Swedish utilities. The defendant is Westinghouse.

**Contention:** Utilities sued Westinghouse for specific performance on uranium supply contracts and/or damages after Westinghouse announced its performance of these contracts was excused because performance would be commercially impracticable.

**Status:** Westinghouse has reached settlements with all utilities except Long Island Lighting where settlement negotiations are ongoing.

#### *Chicago Case (Westinghouse)*

This case was initiated in late 1976 and involves Westinghouse as plaintiff in a proceeding in the US District Court in Chicago, Illinois. The initial defendants were 29 US and non-US organizations as follows:

##### US

Rio Algom Corp.  
Englehard Minerals and Chemicals Corp.  
Denison Mines (US) Inc.  
Gulf Oil Corp.  
Kerr McGee Corp.  
Anaconda Co.  
Getty Oil Co.  
Utah International Inc.  
Phelps Dodge Corp.  
Western Nuclear Corp.

Atlas Corp.

United Nuclear Corp.

Federal Resources Corp.

Pioneer Nuclear Corp.

Homestake Mining Co.

Rio Tinto-Zinc Corp.

Reserve Oil and Minerals Corp.

##### *Canada*

Rio Algom Ltd.

Denison Mines Ltd.

Noranda Mines Ltd.

Gulf Minerals Canada Ltd.

##### *Australia*

Queensland Mines Ltd.

Pancontinental Mining Ltd.

Conzinc Riotinto of Australia Ltd.

Mary Kathleen Uranium Ltd.

##### *South Africa*

Nuclear Fuels Corp. of S.A. Ltd. (NUFCOR)

Anglo American Corp. of S.A. Ltd.

##### *UK*

Rio Tinto-Zinc Corp. Ltd.

RTZ Services Ltd.

**Contention:** Westinghouse has charged the defendants with antitrust violations and seeks treble damages of an unspecified amount.

**Status:** Charges against Reserve Oil and Minerals Corp. and Rio Tinto Zinc Corp. have been dismissed.

Settlements have been concluded with four others: Homestake, Getty, Gulf Oil and Gulf Minerals Canada. As of this writing, an agreement in principle has been announced between Westinghouse and Kerr McGee. Of the remaining defendants, nine have not appeared, and Westinghouse is seeking a default judgment against them. The nine include all non-US defendants except Denison and Noranda. The trial is scheduled to begin September 1981.

Several of the defendants, including Western Nuclear, Kerr-McGee, Atlas, Anaconda and Utah International have filed counter claims against Westinghouse alleging various forms of anti-competitive conduct and seeking trebled damages of an unspecified amount.

##### *TVA—Producers*

This case was initiated in 1977 and involves TVA as plaintiff in a multi-district proceeding in Chicago, Illinois, where discovery has been combined with the

## URANIUM MARKET

Chicago Westinghouse case. Defendants are 13 US and foreign entities as follows:

### US

Rio Algom Corp.  
Englehard Minerals and Chemical Corp.  
Gulf Oil Corp.

### Canada

Gulf Minerals Canada Ltd.  
Rio Algom Ltd.  
Denison Mines Ltd.  
Noranda Mines Ltd.  
Uranerz Canada Ltd.

### South Africa

NUFCOR

### UK

Rio Tinto-Zinc Corp. Ltd.  
RTZ Services Ltd.

### Germany

Urangesellschaft GmbH

### France

Uranex

Contention: TVA has charged the defendants with antitrust violations and is seeking trebled damages of an unspecified amount.

Status: No trial date has been set as yet.

**Reserve/Sohio—Gulf** This suit was filed in September 1977 in New Mexico by Reserve Oil and Minerals Corp. as plaintiff against Gulf, General Atomic and Scallop Nuclear. Sohio subsequently joined the case as a plaintiff.

Contentions: Reserve and Sohio have charged the defendants with antitrust violations and seeking monetary damages and a determination that a 1975 uranium supply contract involving 5.5 million pounds  $U_3O_8$  is invalid. The defendants have filed a counterclaim asking either that the contract be enforced or that they be awarded damages for non-delivery as well as punitive damages.

Status: Discovery ongoing, and no trial date has yet been set.

### Exxon—GPU

This case was filed in early 1979 and involves Exxon as plaintiff and General Public Utilities as defendant in a dispute over a contract option covering  $U_3O_8$  for nine reload batches of fuel.

Contentions: Exxon contends that its obligation to supply  $U_3O_8$  to GPU ended in 1975. Exxon is seeking a declaratory judgment that it has no obligation to delivery  $U_3O_8$ , as well as damages representing the difference between the price received and market price for the first three batches of  $U_3O_8$  delivered under the option in 1976, 1977 and 1978. In a counterclaim, GPU asks a declaratory judgment that the option was accepted properly and constitutes an enforceable contract.

Status: Suit is still in the discovery phase. A pretrial hearing is scheduled for May 1981 at which time it is anticipated that a trial date will be set.

### Bokum—Lilco

This case involves a uranium mine and mill financing agreement between Bokum Resources Corp. and Long Island Lighting Co. (Lilco).

Contention: Lilco contends that Bokum is in default of its financial and other obligations and seeks title to Bokum's mine and mill. Bokum has filed a counterclaim alleging that Lilco interfered with, and prevented the consummation of, a prospective takeover of Bokum by Occidental Petroleum. Bokum is also seeking damages.

Status: Lilco's suit and Bokum's counterclaim have been consolidated in the U.S. District Court in Albuquerque, New Mexico.

### General Atomic—Exxon

This action was filed by General Atomic as plaintiff against Exxon in early 1978 and involves a dispute over a six million pound uranium supply agreement.

Contentions: General Atomic sued Exxon for breach of contract and seeks either specific performance of the contract or damages for non-performance. Exxon filed a counterclaim against General Atomic, Gulf Oil and Scallop Nuclear alleging antitrust violations. Exxon is seeking trebled damages of an unspecified amount and a declaratory judgment that the contract is void.

Status: Trial is currently scheduled to begin in April 1981.

### Getty—Two Utility Groups

This case was initiated in January 1981 and involves Getty Oil and two groups of utilities which had contracted to purchase  $U_3O_8$  from Getty. The plaintiff is Getty; the defendants are a group of four Wisconsin utilities including Wisconsin Electric Power Co. and Wisconsin Public Service Co. and a group of New

## URANIUM MARKET

England utilities comprising Public Service Co. of New Hampshire and other owners of the Seabrook nuclear project.

Contention: Getty has charged the utilities with contract default and antitrust violations and seeks damages and a determination that the contract is valid and enforceable. The utilities have filed a counterclaim against Getty alleging antitrust violations and seeking treble damages of an unspecified amount, dismissal of Getty's suit and a determination that they be relieved of the obligation to purchase uranium from Getty.

Status: Suit recently initiated.

### *Two Utility Groups—12 Uranium Companies*

This is a case filed in Chicago, Illinois, on January 30, 1981 by the Wisconsin and New England utility groups involved in the Getty litigation as plaintiffs against the following as defendants:

#### *US*

Getty Oil Corp.

Gulf Oil Corp.

Homestake Mining Co.

Atlas Corp.

Anaconda Co.

Utah International Inc.

Kerr McGee Corp.

Phelps Dodge Corp.

Western Nuclear Corp.

United Nuclear Corp.

#### *Canada*

Gulf Minerals Canada Ltd.

#### *Australia*

Pancontinental Mining Ltd.

Contention: The utilities have charged the defendants with antitrust violations and are seeking trebled damages of an unspecified amount.

Status: Suit recently initiated.

A number of previously decided suits are currently under appeal. A major dispute over the supply of some 27 million pounds of  $U_3O_8$  involves United Nuclear and General Atomic. A default judgment against General Atomic by the New Mexico state trial court was affirmed by the New Mexico Supreme Court. General Atomic has asked for review by the US Supreme Court; The Supreme Court has not yet responded to the request for review. An arbitration

award in favor of General Atomic against United Nuclear has been set aside in the New Mexico court and is being appealed by General Atomic. Other suits that are still under appeal include Atlas—Iowa Electric and Homestake—Washington Public Power Supply System (WPPSS).

There have been a number of major suits settled over the past few years, including: WPPSS—Kerr McGee; Ranchers Exploration and Development Corporation—General Atomic; Kerr McGee—CAPCO Group; Pennsylvania Power & Light—General Atomic; Boston Edison—Atlas; and Carolina Power & Light—Uranex.

Recently, WPPSS requested assurances from Exxon that it would honor two uranium supply contracts signed in the early 1970's. This action by WPPSS is the outflow of a letter from Exxon stating that those contracts are "unenforceable." The contracts are in connection with reload fuel for the WNP-2 and WNP-3 nuclear units.

## CANADA

The Key Lake Board of Inquiry, appointed in December 1979 to make recommendations regarding resource development in the Key Lake area of Saskatchewan, has recently published the report of its findings. Following is a summary of the Key Lake Development as presented by the Board. A discussion of the findings of the Board and its recommendations will appear in Nuexco Report 152.

The Key Lake project involves the construction and operation of a uranium mine and mill in the central area of northern Saskatchewan. It is being developed by the Saskatchewan Uranium Joint Venture, which is owned by Saskatchewan Mining Development Corporation (one-half), Uranerz Exploration and Mining Limited (one-third) and Eldor Resources Limited (one sixth). On March 1, 1979, the owners formed Key Lake Mining Corporation (KLMC) to bring the mine and mill into production and to operate the facilities. KLMC is also responsible for exploration on the mineral lease surrounding the two orebodies discovered to date. SMDC is a Crown Corporation owned by the Government of Saskatchewan. The Corporation was established in 1974 to participate in



## URANIUM MARKET

the development of the hard-rock mineral sector of the province's resources industry.

The uranium at Key Lake is contained in two orebodies, known as the Gaertner and the Deilmann deposits. Both are long and narrow, covering a cumulative length of approximately 2.6 km. The orebodies are relatively close to the surface and are covered partially by small lakes and by 20 to 100 meters of earth deposited by glaciers.

The Gaertner deposit was discovered by the joint venture in August, 1975 and is approximately 80 meters wide and 50 meters in thickness. The Deilmann orebody was discovered in July, 1976 and is approximately 200 meters wide and up to 160 meters in thickness. These orebodies have an average grade of about 2.5 percent  $U_3O_8$ . Reasonably assured resources at Key Lake are estimated to be in excess of 150 million pounds  $U_3O_8$ . The proposed project at Key Lake involves the development of an open pit operation for each of the two orebodies.

The mining of ore at Key Lake is proposed to begin in 1983 and will continue until at least 1998. Ore removal is scheduled to begin about six months before startup of the mill. Mill startup will probably be in late 1983 or early 1984.

The annual mill capacity of the project will be at least eight million pounds  $U_3O_8$ , and may be as high as 12 million pounds, depending upon market conditions.

### FAR EAST

Japan's Ministry of International Trade and Industry (MITI) has already called into question the recently established official target of having at least 51,000 MWe of nuclear capacity on line by the end of 1990. (See Nuexco Report 149.) The internal MITI report concludes that unless the present siting and related licensing problems are resolved, 1990 nuclear capacity is unlikely to exceed 45,000 MWe, thus eventually requiring a downward revision of the official target.

PNC of Japan has announced that it intends, during the fiscal year beginning April 1, 1981, to spend nearly US \$25 million in its continuing program of uranium exploration. Both venture independent and joint projects are planned in various areas including Niger, northern Saskatchewan (with SMDC), the United States (with Conoco), Zambia, Gabon, and Australia (with Pancontinental), among

others. While concentrating in countries and areas of known potential, PNC is also actively looking into frontier areas with the hope that new finds will further add to supply security.

Recent Australian-Japanese ministerial meetings in Tokyo highlighted not only the benefits, but also the potential frustrations and problems for the two partners in resources trade. As a supplier, Australia called on Japan to provide realistic data on future coal demand. The Australians emphasized that new coal development was contingent upon Australian confidence about future demand, as well as reasonable prices. A similar Australian attitude no doubt exists with respect to uranium, but is complicated by foreign policy considerations, such as the necessity of negotiating a new bilateral safeguards agreement, and by additional commercial considerations such as Australian desires to enter the enrichment business. The Australian enrichment plans may conflict with steady Japanese progress in developing their centrifuge technology, a key ingredient of nuclear independence. Thus, the normally straightforward buyer/seller relationship is entangled with the political, economic and foreign policy goals of each country and may result in transactions which appear at variance with market parameters determined solely by supply and demand.

### UNITED STATES

US utilities continue to experience the effects of the March 28, 1979 accident at Three Mile Island. The USNRC now anticipates additional delays in the licensing process for construction and operation of new US nuclear power plants. The licensing setbacks from TMI began on May 21, 1979 when the NRC staff reported that no new operating licenses or construction permits would be issued for nuclear plants for at least three months. This policy was extended in early October 1979 by the adoption of an interim licensing policy which allowed licensing hearings to continue in certain cases but which limited the issuance of licenses during the reassessment of the NRC's structure and regulatory authority.

In February 1980, the NRC approved a list of 38 new requirements for issuance of an operating license and soon thereafter lifted its year-long licensing moratorium with the granting of a *near term* operating license to TVA for Sequoyah unit 1. This type of



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license authorizes fuel loading and zero power testing and includes a provision for five percent power testing contingent on additional approval by the NRC office of Nuclear Reactor Regulation.

Since then, similar licenses have been issued to Virginia Electric & Power Co. for North Anna unit 2 and Public Service Electric & Gas Co. for Salem unit 2. North Anna unit 2 began commercial operation in December 1980. Salem unit 2 is scheduled to receive a full power license during 1981. Alabama Power Company's Farley unit 2 was granted a low-power license in early September 1980 but the plant has not yet begun fuel loading.

The most recent licensing event was the January 23, 1981 issuance of a zero power testing license to Duke Power Company for McGuire unit 1. A full power license for McGuire could be delayed by the reopening of hearings.

Sequoyah unit 1 received the first full power operating license since TMI on September 16, 1980. The license was conditional as it had several attached stipulations mainly dealing with testing of the hydrogen control system in the ice condenser containment structure. Sequoyah unit 1 will be allowed to operate under this conditional license for another year, pushing a commercial operation date to some time beyond January 1982.

Although 1980 saw the resumption of licensing action, recent NRC statements have dampened any enthusiasm which might have been stimulated by the lifting of the licensing moratorium.

The NRC presently anticipates that operating licenses will be issued during 1981 only for Salem unit 2, Farley unit 2, LaSalle unit 1 (Commonwealth Edison) and Sequoyah unit 2. The NRC cites extended hearings and additional elapsed time between the close of hearings and the issuance of Licensing Board rulings for pushing licensing decisions into 1982 and 1983.

Applications for construction permits are affected by similar problems and have been relegated to a secondary priority by the NRC. The first post-TMI construction permit is not expected before mid-1982.

Table 1 chronicles the changes over the past two years in estimated reactor startup schedules. In view of the latest NRC statements, even the most recent forecasts of startup dates are questionable. Recent announcements of licensing delays add increased uncertainty to forecasts of commercial operating dates.

In addition to the plants mentioned above, the facilities most likely to be affected by the licensing slowdown are: Diablo Canyon units 1 and 2, San Onofre unit 2; Sumner; Zimmer; Susquehanna unit 1;

Table 1  
ESTIMATED COMMERCIAL OPERATION TIMES  
FOR NEW US NUCLEAR POWER PLANTS  
(number of units per year)

| Year<br>of Commercial<br>Operation | Time of Estimate |                         |                          |                      | Current<br>Nuexco<br>Estimate |
|------------------------------------|------------------|-------------------------|--------------------------|----------------------|-------------------------------|
|                                    | Before TMI       | Six Months<br>After TMI | Feb 1981<br>Nuclear News | Nuexco<br>Report 147 |                               |
| 1979                               | 9                | 3                       | 1                        | 1                    | 1                             |
| 1980                               | 10               | 11                      | 2                        | 1                    | 1                             |
| 1981                               | 11               | 7                       | 7                        | 3                    | 2                             |
| 1982                               | 13               | 10                      | 9                        | 5                    | 3                             |
| 1983                               | 10               | 10                      | 15                       | 5                    | 5                             |
| 1984                               | 8                | 9                       | 9                        | 6                    | 5                             |
| TOTALS                             | 61               | 50                      | 43                       | 21                   | 17                            |

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Comanche Peak unit 1; Waterford unit 3; Shoreham; and Fermi unit 2.

Of the plants referred to in this section, Nuexco believes the breakdown by year will be two plants going into commercial operation in 1981, three in 1982, five in 1983, five in 1984, and one in 1985.

### TRANSACTIONS

Two material transactions are reported this month. The first involves the sale of between 50 and 100 thousand pounds  $U_3O_8$  from a US producer to a US utility for delivery later this year. The second is a sale of between 300 and 600 thousand pounds  $U_3O_8$  by a US utility to another US company for delivery in 1981. The prices in both transactions were related to market price at the time of delivery.

Several major transactions are under negotiation at this time. Some of the details of these transactions are tabulated in Table 2. The total quantity involved in the four transactions is about ten million pounds  $U_3O_8$ , indicating the resurgence of interest in longer term material. It is noteworthy that base price escalated deals are being discussed in some cases as well as market related contracts.

Table 2  
PENDING TRANSACTIONS

| Nuexco<br>Reference<br>Number | Approx. Quantity<br>(millions of<br>pounds $U_3O_8$ ) | Approx. Price<br>(percent of E.V.) |
|-------------------------------|-------------------------------------------------------|------------------------------------|
| 1253                          | 2 to 4                                                | market related                     |
| 1289                          | 1 to 2                                                | market related                     |
| 1305                          | 2 to 4                                                | 100                                |
| 1373                          | 2 to 4                                                | 100                                |

The **Transaction Value** remained at \$27.20 per pound  $U_3O_8$ , unchanged from last month. No new qualifying transactions closed, so the Transaction Value sample remained unchanged.

### PRICING

The **Exchange Value** remained at \$25.00 per pound  $U_3O_8$ , unchanged from last month. The most important factors involved in the Exchange Value's remaining at the \$25.00 level include:

1. A large amount of material is currently under

negotiation at prices about equal to current Exchange Value.

2. Many sellers are now offering material at about current Exchange Value. For the most part, they are waiting for buyers' responses rather than aggressively discounting prices in order to make sales.

3. There are indications that substantial new near term demand might come into the market as producer-buyers continue to evaluate their options at this price level.

Near term material now available for sale, as listed in the *Market Opportunities* section of this Report, totals 8.5 million pounds  $U_3O_8$ . Active inquiries to purchase amount to 900,000 pounds  $U_3O_8$ . Lower prices would normally be expected to remove some of the available supply from the market, however the reverse has apparently happened. Many sellers have followed the market down and are still interested in selling at today's prices; others have recently entered or re-entered the market. Available near term supply is now at its highest level in recent years. Approximately 45 percent of this near term material is being offered by primary producers; the balance is being offered by inventory holders.

### CONVERSION

This month has seen increased activity in the longer term secondary market for conversion services. Utilities in need of long term conversion supply are exploring opportunities to purchase conversion from other utilities holding excess supplies under contract. As indicated in the Market Opportunities section of this Report inquiries to sell conversion services in the near term secondary market totaled 4.1 million pounds U as  $UF_6$ . Inquiries to purchase conversion services in the same time frame amounted to 1.4 million pounds U as  $UF_6$ . Thus the near term market is one of oversupply, dominated by  $UF_6$  inventory holders wishing to move material through "deconverting" it to concentrates. On the other hand, the longer term market shows more demand than available supply.

The **Conversion Value** remained constant at \$1.20 per pound U as  $UF_6$ . There is one pending transaction between two US utilities for secondary conversion services at a price close to Conversion Value.

## TOPICAL ESSAY

## WORLD DEMAND: PART I, THE US

*Demand* in the uranium industry is a concept that has proved difficult to define and even more difficult to calculate. From time to time, Nuexco has published a series of figures called Apparent Future Consumption (AFC), which frequently have been mistaken for demand. These AFC figures were most recently updated in Nuexco Report 147. However, AFC is quite different from demand; AFC is merely a subset of demand. This essay treats Nuexco's estimate of uranium demand in the US. It also discusses in detail the distinction between AFC and demand.

Apparent Future Consumption is Nuexco's estimate of that portion of demand which corresponds to reactor requirements. That is, if the uranium industry were in a market environment such that price, security of supply and political influences were not considerations, material would be required in the quantity and on the time schedule of AFC in order to keep the reactors running under the assumed conditions.

AFC is a computation of the amount of  $U_3O_8$  which would be used to fabricate fuel for loading and reloading reactors operating, under construction or on order. It is compiled and computed on a reactor by reactor basis, with the quantities for each reactor being based on specific core characteristics, 0.25% tails assay, no recycling, 24 month lead time for procuring first cores and 18 month lead time for procuring each reload. Where reload schedules are unknown, it is assumed that reloads occur one year after commercial operating date and annually thereafter. Nuexco estimates of individual reactor capacity factors are used.

Demand, on the other hand, includes the effects of price, security of supply and political influences; more accurately, it includes the buyers' perceptions of these factors. Demand, as defined by Nuexco, refers to buyers' stated, or otherwise indicated, willingness to buy uranium now or at some time in the future.

Differences between the two for any individual utility could be significant:

1. A utility could choose to reduce inventory by procuring less uranium than needed for its reactors. Thus demand for that utility would be less than AFC.

2. A buyer could choose to increase inventory by buying more than required for current needs, simply

to enhance security of supply.

3. Utilities frequently plan their procurement strategies to achieve a very high probability of obtaining at least enough uranium to meet commitments as they arise, so they tend to procure more than actually required for current needs. For example, utility buyers often assume a higher-than-expected capacity factor, and a sooner-than-expected need date.

4. A buyer's obligation to a supplier of fuel cycle services such as conversion, enrichment or fabrication may require earlier purchase of uranium than a reactor's operating schedule would otherwise require.

The uranium demand for US electric utilities is carried in the Nuexco data base as an individual entry for each reactor. The entries are then grouped by utility. These data are continuously updated to reflect changes in each utility's situation. The amount of uranium a utility might be willing to purchase is a function of several variables, any one of which can change enough to reverse a previous decision to buy or wait. For example:

1. A utility may perceive its need for uranium based on internally generated estimates of requirements. A construction delay could cause the utility to defer procurement plans to keep pace with the construction. This variable could also change as the result of outside factors such as a change in tails assay, estimated capacity factor, or fuel exposure.

2. A utility's view of the need for security of supply may change as the world uranium supply picture evolves, and the utility may alter its demand schedule accordingly. In the mid-1970's, when supply appeared short, many utilities became concerned with their lack of assured supply, and aggregate demand increased well above AFC, particularly over the short term. Now that a uranium shortage appears unlikely, some utilities have elected to maintain a zero inventory policy, confident that even if a uranium shortage did occur, their needs would be met by other utilities holding large inventories or by the government.

3. Changes may occur in a utility's perception of its supply already under contract. If a quantity of uranium previously thought to be secured by contract becomes unavailable through renegotiation or litigation, the utility's demand could suddenly increase even though its AFC had not changed.

The aggregate figures for US utility demand, US utility demand less AFC, US utility unfilled demand,

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and US unsold production are tabulated in Tables 3, 4, 5 and 6 respectively, through 1990. The definition of and methodology involved in determining the numbers in Table 3 are discussed above. Table 4 shows the degree to which utility demand exceeds the AFC published in Nuexco Report 147; generally demand is some 50% higher than AFC. This reflects utility caution and desire for security of supply.

Unfilled demand (Table 5) are simply the sum of each utility's demand less material under contract. This is calculated on a utility by utility basis rather than adding all the utility demand and subtracting all the contracted supply. Finally, US unsold production (Table 6) is that portion of Nuexco's estimate of

total US production, also published in Report 147, which has not yet been contractually committed. Note that US uncommitted *capacity* is significantly larger than estimated unsold production.

AFC is the component of demand which can be empirically derived and evaluated. But demand is more complex than that, for it encompasses the unquantifiable market perceptions of the buyers. In the final analysis, it is demand, and not AFC, which directly impacts on the uranium market at any given time.

Non-US demand and the implications of the differences between demand and AFC will be discussed further in subsequent Nuexco Reports.

Table 3  
US UTILITY DEMAND  
(millions of pounds U<sub>3</sub>O<sub>8</sub>)

|             | 1981 | 1982 | 1983  | 1984  | 1985  | 1986  | 1987  | 1988  | 1989  | 1990  |
|-------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Annual:     | 36.6 | 37.3 | 42.4  | 48.3  | 52.9  | 55.9  | 55.9  | 56.9  | 57.5  | 57.3  |
| Cumulative: | 36.6 | 73.9 | 116.3 | 164.6 | 217.5 | 273.4 | 329.3 | 386.2 | 443.7 | 501.0 |

Table 4  
US UTILITY DEMAND LESS AFC  
(millions of pounds U<sub>3</sub>O<sub>8</sub>)

|             | 1981 | 1982 | 1983 | 1984 | 1985 | 1986  | 1987  | 1988  | 1989  | 1990  |
|-------------|------|------|------|------|------|-------|-------|-------|-------|-------|
| Annual:     | 15.7 | 14.4 | 15.3 | 17.9 | 20.1 | 20.4  | 20.8  | 19.3  | 17.1  | 17.0  |
| Cumulative: | 15.7 | 30.1 | 45.4 | 63.3 | 83.4 | 103.8 | 124.6 | 143.9 | 161.0 | 178.0 |

Table 5  
US UTILITY UNFILLED DEMAND  
(millions of pounds U<sub>3</sub>O<sub>8</sub>)

|             | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989  | 1990  |
|-------------|------|------|------|------|------|------|------|------|-------|-------|
| Annual:     | 0.3  | 1.5  | 4.4  | 6.4  | 12.3 | 14.9 | 23.8 | 28.9 | 33.6  | 36.3  |
| Cumulative: | 0.3  | 1.8  | 6.2  | 12.6 | 24.9 | 39.8 | 63.6 | 92.5 | 126.1 | 162.4 |

Table 6  
US UNSOLD PRODUCTION  
(millions of pounds U<sub>3</sub>O<sub>8</sub>)

|             | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|-------------|------|------|------|------|------|------|------|------|------|------|
| Annual:     | 5.3  | 3.3  | 3.9  | 4.6  | 3.5  | 6.8  | 7.7  | 8.4  | 10.1 | 10.2 |
| Cumulative: | 5.3  | 8.6  | 12.5 | 17.1 | 20.6 | 27.4 | 35.1 | 43.5 | 53.6 | 63.8 |



## RAW MATERIALS

### SOUTH TEXAS DISTRICT—PART II

#### Host-Rock Geology

The Tertiary formations of South Texas were deposited in a coastal marine and continental environment. The uranium-bearing formations consist of thick tuffaceous and clay units (the Fant Tuff and Frio Clay); sandstone units (Oakville, Tordilla, Deweesville and Dillworth); and fine to coarse-grained sandstone and conglomeratic units (Goliad and Soledad). The entire sequence is characterized by oscillating depositional patterns marked by facies changes which commonly include any combination of formational deposit. Carbonaceous material and lignite may occur in light to heavy concentrations throughout the more sandy units. The predominant depositional patterns of the Eocene formations are related to beach and barrier-bar structures; the younger formations are associated with continental deposition consisting of fine to coarse sand and conglomeratic units. The source of the fine to coarse sand and conglomeratic material may have originated in West Texas and northern Mexico; and the tuffs were deposited during regional volcanic activity.

Uranium mineralization is commonly found in sand and sand/mud facies filling erosional channels, and in well defined beach and barrier-bar structures. The most important ore deposits are associated with depositional changes in fluvial channel environments. A greater concentration of uranium often occurs where lignite and carbonaceous material are abundantly dispersed throughout sand units, especially where permeability is relatively high. There is also an apparent relationship between the concentrations of uranium and clay minerals present in certain sand/clay host units. The clay particles acted to restrict the normal flow of mineral bearing solutions and consequently afforded the rapid precipitation of uranium, enriching the clay-bearing unit. It was concluded that the uranium deposits of the district were formed by epigenetic process—placement of the uranium; occurred after and totally independent of the deposition of the host formation.

The unoxidized uranium deposits of the district are significantly larger than were the oxidized deposits mined in the 1960's. Unoxidized mineralization has notably formed in anomalous concentrations along sinuous alteration fronts, or roll fronts, similar to deposits in the Tertiary rocks of Wyoming. Low-grade uranium may occur continuously for several

miles along a front; however, the higher grade uranium usually occurs as discrete accumulations randomly distributed along the roll front. Molybdenum, selenium and arsenic occur as accessory minerals to the uranium in certain areas throughout the district. The accessory minerals can be useful as an exploration guide under certain circumstances. Organic material, pyrite and clay minerals are common constituents associated with uranium.

The principal source of uranium mineralization is considered to be the thick volcanic ash (tuff) sequence of Miocene Age that covered the entire region. As the tuff formation eroded, primarily toward the gulf, the contained uranium was leached from the tuff to be absorbed and transported downdip by oxygenated ground water. Precipitation of the uranium in a favorable host rock occurred in a reducing environment. The reducing environment was probably created by the upward migration of hydrogen sulfide and/or methane gas associated with deeper deposits of oil and gas. Formation permeability and faulting are the main factors controlling the migration of the reductants to the surface; thus offering a guide to exploration.

The ore minerals common to the district are both oxidized and unoxidized. The first mining was from shallow open pit mines (average depth about 40 feet) situated along a trend from Deweesville, through Tordilla Hill, and into Live Oak County. About 200,000 tons of ore averaging 0.20 percent  $U_3O_8$  were mined between 1960 and 1964, nearly all of which was oxidized. The principle uranium minerals were autunite—a calcium phosphate of uranium, and tyuyamunite—a calcium, uranium vanadate. Carnotite—a uranium vanadate, was present in minor amounts. Trace amounts of unoxidized mineral uraninite—a uranium oxide, was noted in isolated occurrences, usually in the lower contact portion of the deposit.

The Mabel New deposit was the only important oxidized deposit mined in Live Oak County. The average depth of the deposit was 90 feet, about 50 feet deeper than the oxidized deposits near Deweesville. The characteristics of Mabel New ore were completely different from other deposits. The ore minerals were boltwoodite—a uranium potassium silicate, and weeksite—a uranium potassium silicate high in calcium. The ore occurred as a bedded deposit in a host rock of ferruginous sandstone. The deposit was

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enclosed in a thin bed of fine-grained sandstone tightly cemented by calcite. It was the only deposit of this type in the district.

Unoxidized mineralization was discovered one to two miles downdip from the oxidized deposits in Karnes County in 1963. The principal host for such ores is fine-grained arkosic sandstone and clayey sandstone in beach environment and fluvial channel fill. Most of the unoxidized ore occurs in roll front-type deposits, with the unoxidized zone and the thickest and richest ore on the downdip side of the front. The main ore minerals are uraninite—a uranium oxide, and coffinite—a uranium silicate. Associated minerals consist of molybdenum, selenium and pyrite. The largest and most important ore deposits along the trend are completely unoxidized and occur in the Oakville Sandstone in Live Oak County.

Roll front deposits in sandstone facies of fluvial channels within the Soledad member of the Catahoula Tuff are important in Duval and Webb

County. Ore grade mineralization is known to occur at depths of 2,000 feet or more in the Oakville and Catahoula formations; however, the deepest solution mining is currently between 600 and 700 feet. Due to the depth and low grade nature of certain deposits, in situ solution mining is considered the most practical method of recovery. Table 7 illustrates the geologic sequence of all uranium-bearing formations with relation to rated economic importance of each formation and the main area of mining activity.

Generally, the oxidized ores were characterized by an equilibrium difference between detectable radiation and actual uranium content of the ore. Detailed evaluation of a deposit by core drilling and chemical assaying of samples became an important procedure in final orebody studies. Exploitation of a deposit was dependent upon the proper interpretation of the disequilibrium factor. The problem of disequilibrium in unoxidized ore deposits has been minor to non-existent; even so, project evaluation procedures usually include precautionary measures such as core

**Table 7**  
**GEOLOGIC SEQUENCE OF THE URANIUM-BEARING FORMATIONS IN THE SOUTH TEXAS DISTRICT RATED BY ECONOMIC IMPORTANCE OF URANIUM DEPOSITS AND SHOWING THE PRINCIPAL AREAS BY COUNTIES.**

| Geologic Age | Geologic Unit                      | Economic Rank | County                                              |
|--------------|------------------------------------|---------------|-----------------------------------------------------|
| Pliocene     | Goliad Sandstone                   | 4             | Live Oak, Duval                                     |
| Miocene      | Fleming Formation                  | 1             | Karnes, Live Oak, McMullen, Duval, Jim Hogg, Dewitt |
|              | Oakville Sandstone                 |               |                                                     |
| Oligocene    | Catahoula                          | 2             | Duval, Webb                                         |
|              | Chusa Tuff                         |               |                                                     |
|              | Soledad Conglomerate               |               |                                                     |
|              | Fant Tuff                          |               |                                                     |
|              | Frio Clay                          |               |                                                     |
| Eocene       | Jackson Group (Whitsett Formation) | 3             | Karnes, Wilson, Atascosa                            |
|              | Fashing Clay                       |               |                                                     |
|              | Tordilla Sandstone                 |               |                                                     |
|              | Dubose                             |               |                                                     |
|              | Deweeseville Sandstone             |               |                                                     |
|              | Conquista Clay                     |               |                                                     |
|              | Dilworth Sandstone                 |               |                                                     |



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drilling and chemical assaying of core samples to determine if an equilibrium problem exists and what must be done to compensate for it.

### Mining Activities

Approximately 6.7 million pounds  $U_3O_8$  were produced in the South Texas district during 1980, making it the third largest production center in the U.S. Over 3.1 million pounds  $U_3O_8$  were produced by open pit mining and conventional milling and about 3.6 million pounds by in situ solution mining techniques. In all, the South Texas district has existing production capacity for a total of at least nine to ten million pounds  $U_3O_8$ . However, it is unlikely that production for the next few years will exceed the 1980 level. Conventional production centers have already curtailed operations, or have plans to do so, and more than two-thirds of the 13 in situ solution mining projects are operating below design capacity.

The largest conventional mining and milling operation in the district is the Conquista project which is controlled by Conoco and Pioneer Nuclear. Conoco is project operator. A 3,500 ton per day mill located at Deweesville, Karnes County is the center of activity. As of January 1981, project operations included 12 active mines in various stages of stripping, mining and pit reclamation in Karnes, Live Oak and Gonzales Counties. Operating depths are from 120 to 200 feet. (Figure 1 shows the stripping procedure at one of the Conquista projects.) Conquista currently has 27 active mining permits out of a total 36 issued to date. Even though project operations were curtailed 50 to 60 percent on January 1, permit number 37 for another open pit mine is pending. Past mining from the Whitsett formations has occurred in Wilson, Dewitt and Atascosa Counties. Figure 2 is a photo of the specialized equipment used by Conquista for mining ore.

Chevron Resources Company operates a 3,000 ton per day mill located at Panna Maria in eastern Karnes County. Mill feed is mined from three open pit mines at depths of 120 feet to 180 feet in the Whitsett sandstone units. Chevron has also applied for a mining permit on the Jack Rump ore deposit located about 16 miles northeast of the Panna Maria mill site. In a significant move to enhance uranium operations in the district, Chevron announced in December 1980 that it had signed a letter of intent with Union Carbide Corporation for the purpose of purchasing all mineral interest controlled by UCC on the

Palangana and Rogers properties. It is contemplated that the ore reserves on the Rogers lease could be mined by open pit methods; the Palangana deposit will probably be mined by open pit methods; the Palangana deposit will probably be mined by in situ solution methods.

The Anaconda et al joint venture has proposed an open-pit mine and conventional mill for the large ore deposit located on the Rhode Ranch in McMullen County. The original proposal indicated the mine and mill would support a production rate of 2,000 tons per day. However, it was announced in December 1980 that the project would be delayed indefinitely, pending improved market conditions for uranium. All property evaluation was discontinued at that time.

In situ solution mining, or in situ leaching, technology has advanced rapidly since it was first tested in the district about 1968. It is a highly sophisticated recovery method today, applied by 18 different companies or joint ventures at 14 fully operational in situ leach projects. One pilot plant is operating, two additional plants are under construction, three are in the permitting stage and one more has been proposed. Figure 3 shows the location, project status and ownership of each mining property along the mineral trend.

Uranium recovery for each plant is a function of the flow-through rate of lixiviant given in gallons per minute times the concentration of uranium in the feed. The recovery of uranium from the lixiviant is incidental to the actual leaching process. Throughput of a full production plant varies from about 500 gpm to about 10,000 gpm. Pilot plant operations are usually designed for initial flow below 200 gpm subject to one or two incremental increases to attain the desired throughput level. Upgrading a plant from the pilot stage to a satisfactory production level can be accomplished in six to nine months, depending upon testing time and required process modifications.

Actual  $U_3O_8$  production by in situ solution mining for 1980 varied from less than 50,000 pounds  $U_3O_8$  at the smaller operations to about one million pounds at the largest operations. The average production rate in 1980 for each of the 13 in situ plants was 257,000 pounds  $U_3O_8$ . One of the smaller operations is producing  $U_3O_8$  by a modified in situ solution mining technique. Solution Engineering, Inc. is engaged in reclamation of residual uranium from impounded mill tailings at the Susquehanna Western, Inc. site near Falls City. The tailings are being treated by a



**Figure 1**  
**HEAVY EQUIPMENT UTILIZED IN THE STRIPPING PROCESS AT CONQUISTA PROJECT MINES**

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Figure 2

## SPECIALIZED EQUIPMENT USED FOR ORE REMOVAL AT CONQUISTA PROJECT MINES

method called as in situ heap leaching.

Leaching solution contact with the tailings a manner similar to conventional in situ solution mining. Well patterns are strategically located over the tailings to service the area to be leached.

The residual acid content of the tailings provides the leaching agent which extracts already soluble uranium from the porous tailings. Feed to the recovery plant varies with the areas being leached, but generally contains 20 to 40 parts per million  $U_3O_8$ . The recovery plant has a capacity of 800 gpm featuring a countercurrent continuous ion exchange system and subsequent system to produce dry yellowcake.

### Summary

Participation in exploration and development throughout the South Texas district has continued to gain favor because of exploration success and workable industry regulations. Several distinct mineral trends have been developed to date and new trends have been discovered at greater depths. Drilled reserves of the district are estimated by Nuexco at 140 million

pounds  $U_3O_8$ ; the potential to increase reserves by 50 percent is considered good to excellent. The new trend developing in the Oakville Sandstone through Jim Wells and the eastern part of Duval Counties has much potential. It is inevitable that exploration efforts will migrate eastward to test each uranium-bearing formation at ever-increasing depths.

New property development is completely under the jurisdiction of state agencies. The Railroad Commission of Texas is primarily responsible for open-pit mines; the Texas Department of Water Resources has the responsibility for in situ solution mining; the Department of Health and the Air Control Board contribute to final environmental requirements. Texas is an Agreement State and the Nuclear Regulatory Commission and the Environmental Protection Agency have only indirect jurisdiction. State agencies work in close cooperation with the industry to allow exploitation of uranium deposits. As a result, development of new properties has been steady during the last few years and the district has become one of the most active in the US.

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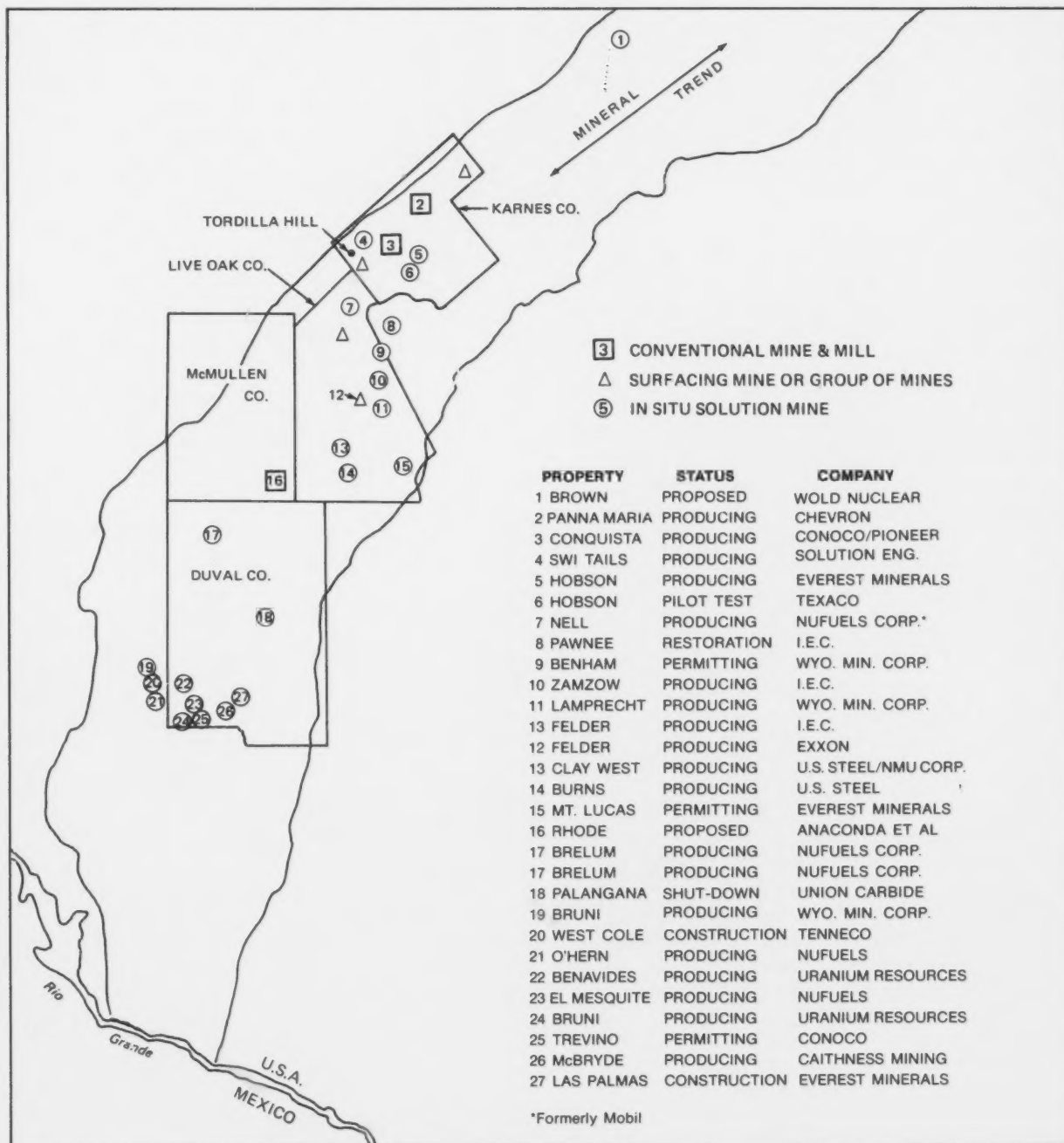


**Figure 3**  
**LOCATION, STATUS AND PRINCIPAL OWNER OF MINING PROPERTIES**  
**ALONG THE SOUTH TEXAS URANIUM TREND**

STATISTICAL DATA

**EXCHANGE VALUE—\$25.00/lb U<sub>3</sub>O<sub>8</sub>**  
Determined as of February 28, 1981

**Definition**

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.

B. Data from pending transactions.

C. Firm bids to buy and firm offers to sell.

D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.

B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

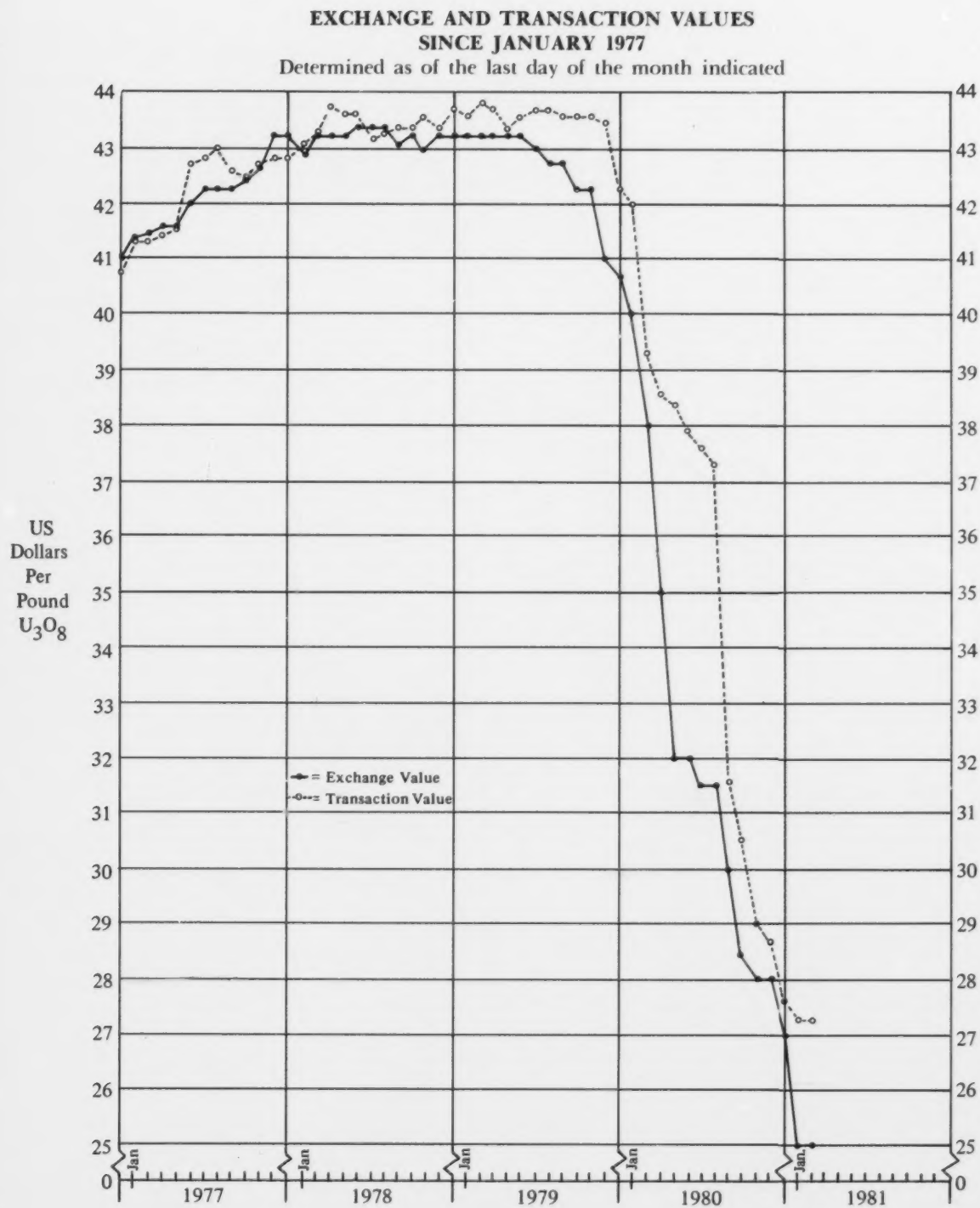
| TRANSACTION VALUE                   |                    |                        |                  |
|-------------------------------------|--------------------|------------------------|------------------|
| Determined as of February 28, 1981  |                    |                        |                  |
| \$/lb U <sub>3</sub> O <sub>8</sub> | Millions of Pounds | Number of Transactions | Number of Months |
| 27.20                               | 3.1                | 10                     | 5                |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U<sub>3</sub>O<sub>8</sub> in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds U<sub>3</sub>O<sub>8</sub> are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.



STATISTICAL DATA





## STATISTICAL DATA

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. UsOs)

|      | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1968 | —     | —     | —     | —     | —     | —     | —     | 6.35  | 6.35  | 6.40  | 6.45  | 6.50  |
| 1969 | —     | 6.35  | 6.10  | 6.10  | 6.25  | 6.25  | 6.20  | 6.20  | 6.15  | 6.15  | 6.15  | 6.20  |
| 1970 | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.20  | 6.15  | 6.15  | 6.15  | 6.15  |
| 1971 | 6.20  | 6.20  | 6.20  | 6.20  | 6.15  | 6.05  | 6.00  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  |
| 1972 | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  |
| 1973 | 5.95  | 6.00  | 6.10  | 6.20  | 6.45  | 6.50  | 6.50  | 6.50  | 6.50  | 6.50  | 6.75  | 7.00  |
| 1974 | 7.70  | 7.90  | 8.00  | 9.00  | 9.50  | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 |       |       |       |       |       |       |       |       |       |       |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. UsOs)

|      | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1976 | —     | —     | —     | —     | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 |       |       |       |       |       |       |       |       |       |       |

EXCHANGE VALUE EXPRESSED IN SELECTED  
PRODUCER & CONSUMER CURRENCIES\*

| Country             | per lb UsOs<br>in Concentrates | per kg UsOs<br>in Concentrates | per kg U<br>in Concentrates |
|---------------------|--------------------------------|--------------------------------|-----------------------------|
| US (dollar)         | 25.00                          | 55.12                          | 64.99                       |
| France (franc)      | 124.32                         | 274.02                         | 323.19                      |
| FRG (mark)          | 52.95                          | 116.75                         | 137.67                      |
| Japan (yen)         | 5,205                          | 11,475                         | 13,532                      |
| Switzerland (franc) | 48.84                          | 107.67                         | 126.97                      |
| UK (pound)          | 11.20                          | 24.69                          | 29.11                       |
| Australia (dollar)  | 21.58                          | 47.58                          | 56.11                       |
| Canada (dollar)     | 30.02                          | 66.19                          | 78.05                       |
| Niger, Gabon (CFA)  | 6,216                          | 13,704                         | 16,160                      |
| South Africa (rand) | 19.52                          | 43.03                          | 50.74                       |

\*Calculated using currency exchange rates published in the Wall Street Journal on the last business day of the month.

**STATISTICAL DATA**

**LOAN USE CHARGE RATE—7.0%/year**

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

- A. Data from recently completed or pending loan transactions.
- B. Rates included in firm proposals to borrow or lend.
- C. Rates that potential borrowers and lenders have expressed a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

**CONVERSION VALUE—\$1.20/lb. U as UF<sub>6</sub>**  
Determined as of February 28, 1981

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near term transactions for significant quantities of conversion services could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

- A. Data from recently completed transactions.
- B. Data from pending transactions.
- C. Firm bids to buy and firm offers to sell.
- D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

- A. The price of conversion services delivered or to be delivered under old contracts.
- B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

## STATISTICAL DATA

## CURRENT TRANSACTIONS\*

| Nuexco<br>Reference<br>Number | Delivery<br>Period | Approximate Quantity<br>(thousands of pounds,<br>U <sub>3</sub> O <sub>8</sub> equivalent) | Approximate<br>Price as<br>percent of<br>Current E.V. | Seller<br>Group | Buyer<br>Group | Remarks                    |
|-------------------------------|--------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------|-----------------|----------------|----------------------------|
| Uranium Transactions          |                    |                                                                                            |                                                       |                 |                |                            |
| 1401                          | 81                 | 50 - 100                                                                                   | —                                                     | US              | US             | Price related<br>to market |
| 1423                          | 81                 | 300 - 600                                                                                  | —                                                     | US              | US             | Price related<br>to market |

## Conversion Transactions

None reported

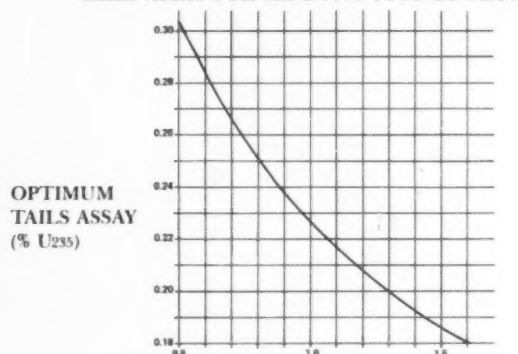
\*Transactions listed include not only those in which Nuexco was involved, but also all others of which Nuexco is aware.

STATISTICAL DATA

OPTIMUM TAILS ASSAY

The optimum tails assay is the tails composition at which the cost of enriched uranium is lowest for given costs of separative work (SWU) and natural uranium feed. It depends only on the ratio of the cost of a kilogram of natural uranium in the form of  $UF_6$  to the cost of a kilogram unit of separative work. The US Department of Energy (USDOE) Adjustable Fixed Commitment (AFC) enrichment contract holders have the option, within limits, to specify the transaction tails assay. The transaction tails assay for USDOE Requirements contracts is 0.2 percent  $U_{235}$ . For every one-hundredth of one percent increase in the transaction tails assay, uranium consumption increases about two percent.

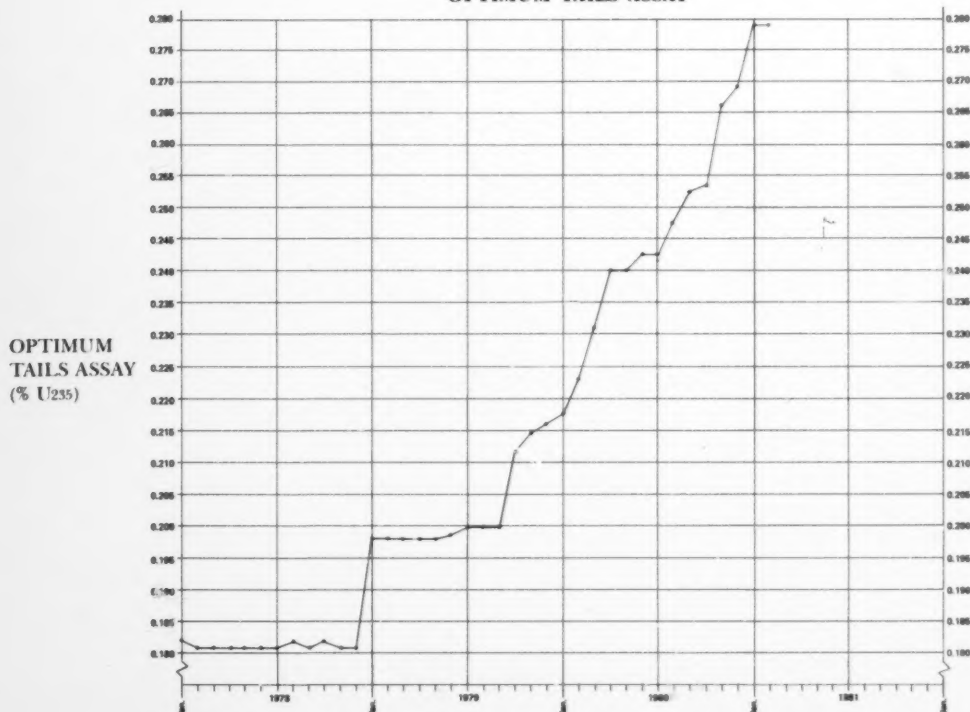
TAILS ASSAY FOR MINIMUM COST OF PRODUCT\*



Ratio of Unit Cost of Feed to Unit Cost of SWU

\*From Nuexco Report 138

OPTIMUM TAILS ASSAY<sup>1</sup>



<sup>1</sup>Based on Exchange Value and USDOE AFC SWU price; interpolated to the nearest thousandth.

## STATISTICAL DATA

## US GOVERNMENT STATISTICS

|                                 | Producer Price<br>Index—Industrial<br>Commodities<br>(1967 = 100) <sup>1</sup> | Consumer<br>Price<br>Index<br>(1967 = 100) <sup>2</sup> | GNP<br>Implicit<br>Price<br>Deflator<br>(1972 = 100) <sup>3</sup> | Gross Average Hourly Earnings<br>of Production or Non-supervisory<br>Workers (US\$) <sup>4</sup> |                                               |                                                 |
|---------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------|
|                                 |                                                                                |                                                         |                                                                   | Metal<br>Mining<br>(SIC 10)                                                                      | Primary<br>Non-ferrous<br>Metals<br>(SIC 333) | Chemicals<br>and Allied<br>Products<br>(SIC 28) |
| Annual Avg. 1970 <sup>(5)</sup> | 110.0                                                                          | 116.3                                                   | 91.36                                                             | 3.88                                                                                             | 3.87                                          | 3.69                                            |
| Annual Avg. 1971 <sup>(5)</sup> | 114.1                                                                          | 121.3                                                   | 96.02                                                             | 4.12                                                                                             | 4.15                                          | 3.97                                            |
| Annual Avg. 1972 <sup>(5)</sup> | 117.9                                                                          | 125.3                                                   | 100.00                                                            | 4.56                                                                                             | 4.59                                          | 4.26                                            |
| Annual Avg. 1973 <sup>(5)</sup> | 125.9                                                                          | 133.1                                                   | 105.80                                                            | 4.84                                                                                             | 4.98                                          | 4.51                                            |
| Annual Avg. 1974 <sup>(5)</sup> | 153.8                                                                          | 147.7                                                   | 116.02                                                            | 5.44                                                                                             | 5.63                                          | 4.88                                            |
| Annual Avg. 1975 <sup>(5)</sup> | 171.5                                                                          | 161.2                                                   | 127.15                                                            | 6.13                                                                                             | 6.24                                          | 5.39                                            |
| Annual Avg. 1976 <sup>(5)</sup> | 182.4                                                                          | 170.5                                                   | 133.71                                                            | 6.76                                                                                             | 6.87                                          | 5.91                                            |
| Annual Avg. 1977 <sup>(6)</sup> | 195.1                                                                          | 181.5                                                   | 141.70                                                            | 7.28                                                                                             | 7.67                                          | 6.43                                            |
| Annual Avg. 1978 <sup>(6)</sup> | 209.4                                                                          | 195.4                                                   | 152.05                                                            | 8.23                                                                                             | 8.56                                          | 7.02                                            |
| Annual Avg. 1979 <sup>(6)</sup> | 236.5                                                                          | 217.4                                                   | 165.46                                                            | 9.27                                                                                             | 9.49                                          | 7.60                                            |
| Nov 1979                        | 250.6                                                                          | 227.5                                                   | —                                                                 | 9.78                                                                                             | 9.85                                          | 7.88                                            |
| Dec 1979                        | 253.1                                                                          | 229.9                                                   | 170.58                                                            | 9.80                                                                                             | 9.92                                          | 7.92                                            |
| Jan 1980                        | 260.6                                                                          | 233.2                                                   | —                                                                 | 9.91                                                                                             | 10.06                                         | 7.97                                            |
| Feb 1980                        | 265.9                                                                          | 236.4                                                   | —                                                                 | 9.92                                                                                             | 10.01                                         | 8.01                                            |
| Mar 1980                        | 268.6                                                                          | 239.8                                                   | 174.48                                                            | 9.90                                                                                             | 10.22                                         | 8.05                                            |
| Apr 1980                        | 271.3                                                                          | 242.5                                                   | —                                                                 | 10.00                                                                                            | 10.30                                         | 8.12                                            |
| May 1980                        | 271.9                                                                          | 244.9                                                   | —                                                                 | 10.18                                                                                            | 10.37                                         | 8.17                                            |
| Jun 1980                        | 273.5                                                                          | 247.6                                                   | 178.93                                                            | 10.13                                                                                            | 10.69                                         | 8.24                                            |
| Jul 1980                        | 276.2                                                                          | 247.8                                                   | —                                                                 | 10.24                                                                                            | 10.82                                         | 8.35                                            |
| Aug 1980                        | 278.2                                                                          | 249.4                                                   | —                                                                 | 10.38                                                                                            | 10.78                                         | 8.39                                            |
| Sep 1980                        | 278.8                                                                          | 251.7                                                   | 182.92                                                            | 10.54                                                                                            | 10.94                                         | 8.46                                            |
| Oct 1980                        | 281.2                                                                          | 253.9                                                   | —                                                                 | 10.58                                                                                            | 11.00                                         | 8.52                                            |
| Nov 1980                        | 282.7                                                                          | 256.2                                                   | —                                                                 | 10.73                                                                                            | 11.06                                         | 8.59                                            |
| Dec 1980                        | 286.1                                                                          | 258.4                                                   | 183.98                                                            | 10.83P                                                                                           | 11.29P                                        | 8.67P                                           |
| Jan 1981                        | 289.9P                                                                         | 260.5                                                   | —                                                                 | —                                                                                                | —                                             | 8.67P                                           |

P = Preliminary R = Revised since last month

(1) US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

(2) US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

(3) US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

(4) US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1976-1976 are adjusted to the March 1977 benchmark. Data for January 1977 and beyond are adjusted to the March 1979 benchmark.

(5) Data for 1970-1976, monthly except for the GNP Implicit Price Deflator, and Price Index data for 1977-1978 appear on pages 4.6-4.8 of Nuexco Report 139.

(6) Employment and Earnings data for 1977-1979, monthly, appear on page 33 of Nuexco Report 147.

STATISTICAL DATA

AUSTRALIAN GOVERNMENT STATISTICS

|                                 | Price Index of Materials<br>Used in Manufacturing<br>Industry—All Groups<br>(Year 1968-69 = 100.0) <sup>1</sup> | Weighted Average<br>Minimum Weekly Wage<br>Rates—Adult Males<br>Australia<br>Mining and Quarrying (A\$) <sup>2</sup> |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Annual Avg. 1970 <sup>(3)</sup> | 101.4                                                                                                           | 59.88                                                                                                                |
| Annual Avg. 1971 <sup>(3)</sup> | 101.5                                                                                                           | 65.95                                                                                                                |
| Annual Avg. 1972 <sup>(3)</sup> | 105.6                                                                                                           | 71.26                                                                                                                |
| Annual Avg. 1973 <sup>(3)</sup> | 124.4                                                                                                           | 78.96                                                                                                                |
| Annual Avg. 1974 <sup>(3)</sup> | 141.9                                                                                                           | 108.07                                                                                                               |
| Annual Avg. 1975 <sup>(3)</sup> | 150.4                                                                                                           | 132.55                                                                                                               |
| Annual Avg. 1976 <sup>(3)</sup> | 168.4                                                                                                           | 160.93                                                                                                               |
| Annual Avg. 1977 <sup>(3)</sup> | 192.0                                                                                                           | 179.03                                                                                                               |
| Annual Avg. 1978 <sup>(3)</sup> | 215.4                                                                                                           | 190.04                                                                                                               |
| Annual Avg. 1979                | 248.5                                                                                                           | 196.34                                                                                                               |
| Sep 1979                        | 302.4                                                                                                           | 202.24                                                                                                               |
| Oct 1979                        | 309.4                                                                                                           | 201.71                                                                                                               |
| Nov 1979                        | 310.4                                                                                                           | 201.05                                                                                                               |
| Dec 1979                        | 319.4                                                                                                           | 201.85                                                                                                               |
| Jan 1980                        | 340.1                                                                                                           | 215.72                                                                                                               |
| Feb 1980                        | 345.6                                                                                                           | 215.18                                                                                                               |
| Mar 1980                        | 340.3                                                                                                           | 214.81                                                                                                               |
| Apr 1980                        | 327.9                                                                                                           | 215.12                                                                                                               |
| May 1980                        | 335.1                                                                                                           | 214.79                                                                                                               |
| Jun 1980                        | 338.4                                                                                                           | 214.12                                                                                                               |
| Jul 1980                        | 349.1                                                                                                           | 221.41                                                                                                               |
| Aug 1980                        | 353.2                                                                                                           | 219.70                                                                                                               |
| Sep 1980                        | 351.6                                                                                                           | 219.21R                                                                                                              |
| Oct 1980                        | 348.7                                                                                                           | 220.48                                                                                                               |
| Nov 1980                        | 351.0P                                                                                                          | 220.85P                                                                                                              |
| Dec 1980                        | —                                                                                                               | 221.18P                                                                                                              |

P = Preliminary R = Revised since last month

- (1) Australian Bureau of Statistics, Canberra; "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.  
 (2) Australian Bureau of Statistics, Canberra; "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest fourteen months shown are subject to revision.  
 (3) Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.



## STATISTICAL DATA

## CANADIAN GOVERNMENT STATISTICS

|                  | Industry Selling<br>Price Index:<br>Manufacturing<br>(D 500000) <sup>1,2</sup><br>(1971 = 100.0) | Wage-earner Data:<br>Average Hourly Earnings (C\$) <sup>3,4</sup> |                                                              |                                                        |
|------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------|
|                  |                                                                                                  | Metal Mining,<br>including<br>milling<br>(SIC 050-059)            | Primary Metal<br>Industries,<br>non-ferrous<br>(SIC 296-298) | Chemicals and<br>Chemical<br>Products<br>(SIC 370-379) |
| Annual Avg. 1977 | 174.3                                                                                            | 8.18                                                              | 6.50                                                         | 6.51                                                   |
| Annual Avg. 1978 | 190.4                                                                                            | 8.76                                                              | 6.82                                                         | 6.97                                                   |
| Annual Avg. 1979 | 217.9                                                                                            | 9.60                                                              | 7.35                                                         | 7.67                                                   |
| Oct 1979         | 227.4                                                                                            | 9.89                                                              | 7.54                                                         | 7.88                                                   |
| Nov 1979         | 228.1                                                                                            | 9.97                                                              | 7.61                                                         | 7.91                                                   |
| Dec 1979         | 230.4                                                                                            | 9.93                                                              | 7.51                                                         | 7.89                                                   |
| Jan 1980         | 239.0                                                                                            | 9.96                                                              | 7.57                                                         | 7.99                                                   |
| Feb 1980         | 240.8                                                                                            | 10.11                                                             | 7.69                                                         | 8.08                                                   |
| Mar 1980         | 239.5                                                                                            | 10.34                                                             | 7.83                                                         | 8.26                                                   |
| Apr 1980         | 241.1                                                                                            | 10.40                                                             | 7.94                                                         | 8.36                                                   |
| May 1980         | 242.4                                                                                            | 10.50                                                             | 8.01                                                         | 8.44                                                   |
| Jun 1980         | 243.7                                                                                            | 10.51                                                             | 8.07                                                         | 8.46                                                   |
| Jul 1980         | 246.3                                                                                            | 10.49                                                             | 8.11                                                         | 8.55                                                   |
| Aug 1980         | 249.3R                                                                                           | 10.58                                                             | 8.14                                                         | 8.65                                                   |
| Sep 1980         | 251.9R                                                                                           | 10.85                                                             | 8.24                                                         | 8.71                                                   |
| Oct 1980         | 255.6R                                                                                           | 11.05P                                                            | 8.28P                                                        | 8.82P                                                  |
| Nov 1980         | 257.2                                                                                            | 11.18P                                                            | 8.34P                                                        | 8.76P                                                  |
| Dec 1980         | 257.5P                                                                                           | —                                                                 | —                                                            | —                                                      |

P = Preliminary R = Revised since last month

(1) Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

(2) Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

(3) Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

(4) Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

STATISTICAL DATA

REPUBLIC OF SOUTH AFRICA STATISTICS

|                                 | Average Declared Working<br>Costs per Metric Ton of<br>Gold Ore Milled (Rand) <sup>1</sup> | Consumer<br>Price Index <sup>2</sup><br>(1975 = 100, except where<br>otherwise indicated) |
|---------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Annual Avg. 1970 <sup>(3)</sup> | 7.34                                                                                       | 100.3 <sup>(4)</sup>                                                                      |
| Annual Avg. 1971 <sup>(3)</sup> | 7.88                                                                                       | 106.4 <sup>(4)</sup>                                                                      |
| Annual Avg. 1972 <sup>(3)</sup> | 8.79                                                                                       | 113.3 <sup>(4)</sup>                                                                      |
| Annual Avg. 1973 <sup>(3)</sup> | 10.51                                                                                      | 124.1 <sup>(4)</sup>                                                                      |
| Annual Avg. 1974 <sup>(3)</sup> | 13.18                                                                                      | 138.5 <sup>(4)</sup>                                                                      |
| Annual Avg. 1975 <sup>(3)</sup> | 16.71                                                                                      | 157.2 <sup>(4)</sup>                                                                      |
| Annual Avg. 1976 <sup>(3)</sup> | 19.30                                                                                      | 174.7 <sup>(4)</sup>                                                                      |
| Annual Avg. 1977 <sup>(3)</sup> | 23.87                                                                                      | 194.4 <sup>(4)</sup>                                                                      |
| Annual Avg. 1978 <sup>(3)</sup> | 27.14                                                                                      | 137.2                                                                                     |
| Annual Avg. 1979 <sup>(3)</sup> | 30.18                                                                                      | 155.3                                                                                     |
| Nov 1979                        | —                                                                                          | 163.4                                                                                     |
| Dec 1979                        | 31.89                                                                                      | 164.0                                                                                     |
| Jan 1980                        | —                                                                                          | 165.4                                                                                     |
| Feb 1980                        | —                                                                                          | 167.0                                                                                     |
| Mar 1980                        | 33.65                                                                                      | 168.0                                                                                     |
| Apr 1980                        | —                                                                                          | 170.0                                                                                     |
| May 1980                        | —                                                                                          | 171.9                                                                                     |
| Jun 1980                        | 34.48                                                                                      | 174.6                                                                                     |
| Jul 1980                        | —                                                                                          | 177.2                                                                                     |
| Aug 1980                        | —                                                                                          | 179.2                                                                                     |
| Sep 1980                        | 36.19                                                                                      | 182.8                                                                                     |
| Oct 1980                        | —                                                                                          | 186.3                                                                                     |
| Nov 1980                        | —                                                                                          | 187.8                                                                                     |
| Dec 1980                        | —                                                                                          | 189.9                                                                                     |
| Jan 1981                        | —                                                                                          | —                                                                                         |

(1) Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

(2) Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

(3) Historical data for 1970 through 1979 appear on page 4.9 of Nuexco Report 140.

(4) April 1970 = 100.00

# MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

## URANIUM SUPPLY

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U3Os) |              |              | Remarks   |
|-------------------------------|------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                    | 1 to 2 Years | 2 to 3 Years |           |
| Available for Sale:           |                                                |              |              |           |
| 1392                          | 400                                            |              |              |           |
| 1393                          | 60                                             | 175          | 175          | Long term |
| 1475                          | 1000                                           |              |              | UF6       |
| 1480                          | 450                                            |              |              |           |
| 1490                          | 1000                                           |              |              |           |
| 1540                          | 1200                                           |              |              | UF6       |
| 1550                          | 1550                                           | 1050         |              |           |
| 1552                          | 600                                            |              |              |           |
| 1562                          |                                                | 150          | 150          | Long term |
| 1575                          |                                                | 500          | 500          | Long term |
| 1576                          | 500                                            |              |              |           |
| 1581                          | 100                                            | 150          | 150          | Long term |
| 1595                          | 600                                            |              |              |           |
| 1600                          |                                                |              | 200          | Long term |
| 1610                          | 50                                             |              |              |           |
| 1615                          | 400                                            |              |              |           |
| 1627                          | 600                                            |              |              |           |
| TOTALS                        | 8510                                           | 2025         | 1175         |           |

## Available for Loan:

|              |             |  |  |                 |
|--------------|-------------|--|--|-----------------|
| 1429         | 1200        |  |  | UF <sub>6</sub> |
| 1492         | 900         |  |  | UF <sub>6</sub> |
| 1602         | 400         |  |  |                 |
| <b>TOTAL</b> | <b>2500</b> |  |  |                 |

\*Measured from the date of this Report.

**MARKET OPPORTUNITIES**

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

**URANIUM DEMAND**

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U3Os) |              |              | Remarks   |
|-------------------------------|------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                    | 1 to 2 Years | 2 to 3 Years |           |
| Inquiries to Purchase:        |                                                |              |              |           |
| 1459                          |                                                |              | 200          | Long term |
| 1462                          |                                                |              | 100          | Long term |
| 1514                          | 400                                            |              |              |           |
| 1529                          |                                                |              | 550          | Long term |
| 1534                          | 250                                            |              |              |           |
| 1587                          |                                                | 275          | 275          | Long term |
| 1603                          | 100                                            | 100          | 100          | Long term |
| 1640                          | 150                                            |              |              |           |
| TOTALS                        | 900                                            | 375          | 1225         |           |

**Inquiries to Borrow:**

|              |            |  |
|--------------|------------|--|
| 1621         | 300        |  |
| <b>TOTAL</b> | <b>300</b> |  |

\*Measured from the date of this Report.

# MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the secondary market for UF<sub>6</sub> conversion services. The data presented in this section are in no way intended to be indicative of the entire market for the time period covered.

## CONVERSION SUPPLY

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U as UF <sub>6</sub> ) |              |              | Remarks   |
|-------------------------------|-----------------------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                                     | 1 to 2 Years | 2 to 3 Years |           |
| 1451                          | 75                                                              |              |              |           |
| 1540                          | 650                                                             |              |              |           |
| 1584                          | 600                                                             | 200          | 200          |           |
| 1599                          | 800                                                             | 300          |              |           |
| 1607                          | 850                                                             |              |              |           |
| 1609                          | 1000                                                            |              |              |           |
| 1619                          |                                                                 | 175          |              |           |
| 1620                          | 125                                                             |              |              |           |
| 1625                          |                                                                 | 300          | 500          | Long term |
| TOTALS                        | 4100                                                            | 975          | 700          |           |

## CONVERSION DEMAND

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U as UF <sub>6</sub> ) |              |              | Remarks   |
|-------------------------------|-----------------------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                                     | 1 to 2 Years | 2 to 3 Years |           |
| 1492                          | 300                                                             |              |              |           |
| 1594                          | 400                                                             |              | 950          | Long term |
| 1596                          |                                                                 | 650          |              |           |
| 1608                          | 125                                                             | 175          | 175          | Long term |
| 1614                          |                                                                 | 300          | 500          | Long term |
| 1622                          | 500                                                             | 500          | 400          | Long term |
| 1625                          | 75                                                              |              |              |           |
| TOTALS                        | 1400                                                            | 1625         | 2025         |           |

\*Measured from the date of this Report.

INDEX

URANIUM MARKET INDEX

| Topic                                             | Report Number |     |     |      |     |     |     |     |     |     |     |     |  |
|---------------------------------------------------|---------------|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|--|
|                                                   | 139           | 140 | 141 | 142  | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 |  |
| Projected US & Free World Production              | 1.0           |     | 1.2 |      |     |     |     |     | 7   |     | 7   |     |  |
| Actual US & Free World Production                 |               |     | 1.5 |      |     | 5   |     |     | 12  |     |     | 1   |  |
| US Import-Export Balance                          |               |     |     | 6    | 4   |     |     |     | 11  |     |     |     |  |
| Apparent Future Consumption                       |               |     |     |      |     |     |     |     |     |     |     |     |  |
| Estimate                                          |               |     |     | 2, 4 |     | 2   |     |     | 2   |     | 7   |     |  |
| USDOE Forecast of Uranium                         |               |     |     |      |     |     |     |     |     |     |     |     |  |
| Requirements                                      |               |     |     |      |     | 7   |     |     |     |     |     |     |  |
| Uranium Supply & Demand Balance                   |               |     |     | 1    |     |     | 1   | 9   | 10  |     | 9   |     |  |
| Projection of Installed Nuclear Electric Capacity |               | 1.2 | 1.7 |      |     | 3   |     |     | 4   |     |     |     |  |
| Past Nuclear Electric Power Generation            | 1.1           |     |     |      |     |     |     |     | 14  |     | 3   | 2   |  |
| Uranium Sales Summary                             | 1.2           |     |     |      |     |     |     |     | 17  |     |     | 3   |  |
| ERA Sales and Financial Data                      |               |     |     |      |     |     |     | 1   | 13  |     | 2   | 4   |  |
| USDOE Survey of US                                |               |     |     |      |     |     |     |     |     |     |     |     |  |
| Production Potential                              |               |     |     |      |     |     |     | 6   |     |     |     |     |  |
| New Mexico Severance Tax                          |               |     |     |      |     |     |     |     |     | 2   |     |     |  |
| 1980 Supply & Demand Summary                      |               |     |     |      |     |     |     |     |     | 3   |     |     |  |
| INFCE—Nuexco PWR Requirements                     |               |     |     |      |     |     |     |     |     |     |     | 1   |  |

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| 140           | Marketing & Procurement: Delivery & Payment                 | 2.0         | Quartz-Pebble Conglomerates I           | 3.0         |
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# NUEXCO

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## EXECUTIVE SUMMARY & INDUSTRY OVERVIEW NUEXCO REPORT 151

The **Exchange Value** remained at \$25.00 per pound  $U_3O_8$ , unchanged from the previous month. Substantial amounts of uranium in the near term and longer term markets continue to be under serious discussion at this price level. In addition, many sellers have made offers of material at about this level as well.

Total of inquiries to sell in the spot and near term market continued to rise, increasing to about 8.5 million pounds  $U_3O_8$  equivalent. Inquiries to purchase in the spot and near term market showed little change and remains just under one million pounds. Rather than acting as the impetus for buying, the lower prices are bringing more active sellers into the market. Available near term supply is now at its highest level in recent years.

The **Transaction Value** remained constant at \$27.20 per pound  $U_3O_8$ . Two near term transactions closed this month involving US buyers and US sellers. A summary of pending transactions is included in the Report to indicate the large amounts of material moving in the market.

Increased activity in the long term secondary market for conversion services was seen this month. Inquiries to buy in this time frame grew substantially, while inquiries to sell focused on the spot and near term market. The **Conversion Value** stayed the same at \$1.20 per pound U as  $UF_6$ .

With recent USNRC statements on licensing, the US nuclear industry continues to show a bleak post-Three Mile Island picture. These problems are discussed in this month's Report.

Also, this month's Report contains a discussion of the current status of the disputes and litigation going on in the uranium industry.

This month's *Topical Essay* discusses world uranium demand and reviews the difference between Demand and Apparent Future Consumption as defined by Nuexco. The *Raw Materials* essay continues its focus on the South Texas uranium district.

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# NUEXCO

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APRIL 1981

NUMBER 152

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## Monthly Report on the Uranium Market

# NUEXCO

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# NUEXCO

## MONTHLY REPORT ON THE URANIUM MARKET

April 1981

No. 152

JAMES E. VAUGHAN, *EDITOR*

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# NUEXCO

## FOREWORD

We are happy to announce the appointment of Mr. R. Wesley Miller as Vice President, Corporate Planning and Development. Wes joined Nuexco in 1978, and for the past two and one-half years has been primarily responsible for quantitative analysis of the uranium market. In his new position, Wes will retain supervisory responsibility for that function while taking on the responsibility for Nuexco's corporate and strategic planning.

We are also pleased to announce the appointment of Mr. Peter Stork as our representative in Australia. Peter graduated as a Mining Engineer from the Technical University, Clausthal, Federal Republic of Germany and held various mining positions in Germany, Egypt, Africa and Central America prior to taking up permanent residence in Australia in 1961. Since that time, Peter has been closely associated with coal and uranium projects in Australia as Manager of Queensland Mines (Naburlek) and more recently as General Manager of Marketing and Commercial Development for Pancontinental (Jabiluka). He is currently a uranium industry consultant in Australia.

Nuexco Vice President Jim Vaughan delivered a talk at the Nuexco Luncheon on the occasion of the AIE Fuel Cycle Conference in Los Angeles. A copy of his comments is included as an insert to this Report.

The Raw Materials section of last month's Report, Number 151, entitled South Texas District, Part II, contained several typographical errors. A corrected copy of the essay is included as an insert to this Report.

Beginning with this Report, Nuexco will republish the Wholesale Price Index for the Republic of South Africa in the *Statistical Data* Section.



Wes Miller



Peter Stork



## URANIUM MARKET

## GENERAL

## Uranium Disputes—Update

Last month's Report reviewed the status of uranium industry litigation. Since that time, a number of settlements and dismissals have been announced and an update of the situation follows.

## Chicago Case (Westinghouse)

As a consequence of settlements and dismissals, the number of defendants in this case has been reduced to five as follows:

## Australia

Queensland Mines Ltd.

## US

Phelps Dodge Corp.

Englehard Minerals and Chemicals Corp.

Western Nuclear, Inc.

Anaconda Co.

Charges against Pioneer Nuclear Corp. and Federal Resources Corp. were dismissed in early March and those against Atlas Corp. were dismissed in late March. A large settlement with ten non-US companies and two US subsidiaries was announced in mid-March. This group included:

## Australia

Conzinc Riotinto of Australia Ltd.

Pancontinental Mining Ltd.

Mary Kathleen Uranium Ltd.

## Canada

Rio Algom Ltd.

Denison Mines Ltd.

Noranda Mines Ltd.

## South Africa

Anglo-American Corp. of S.A. Ltd.

Nuclear Fuels Corp. of S.A. Ltd. (NUFCOR)

## UK

Rio Tinto-Zinc Corporation Ltd.

RTZ Services Ltd.

## US

Denison Mines (US) Inc.

Rio Algom Corp.

The terms of the settlement call for a cash payment to Westinghouse of \$39 million and the delivery to Westinghouse of 9 million pounds UO<sub>2</sub> over the period 1981-1985 at firm prices subject to escalation. Complete details regarding which companies are providing funds and which companies are providing

UO<sub>2</sub> and in what years have not been made public. Certain information is however available. Pancontinental will pay \$3 million and Mary Kathleen an undisclosed sum. NUFCOR will provide part of the uranium, but no cash. Anglo will participate as a member of NUFCOR. Rio Algom Ltd. will provide some uranium (less than 50 percent of the total) but no cash.

Last month's Nuexco Report noted that Westinghouse and Kerr-McGee had reached agreement in principle on a settlement. That agreement has been effected, as have additional settlements with Utah International, Inc. and United Nuclear Corp.

## Tennessee Valley Authority (TVA)—Producers

In last month's Nuexco Report a list of defendants in this case was published. In an oversight the fact that the case against Urangesellschaft GmbH had been dismissed in 1980 was omitted. During the past month, further settlements and a dismissal were announced. Thus the following four defendants remain in this case:

## Canada

Gulf Minerals Canada Ltd.

Uranerz Canada Ltd.

## US

Englehard Minerals and Chemicals Corp.

Gulf Oil Corp.

The case against Uranex was dismissed at the same time that TVA announced settlements with the following:

## Canada

Rio Algom Ltd.

Denison Mines Ltd.

Noranda Mines Ltd.

## South Africa

NUFCOR

## UK

Rio Tinto-Zinc Corporation Ltd.

RTZ Services Ltd.

## US

Rio Algom Corp.

The settlement provides for a cash payment to TVA of \$2 million, cancellation of the 1974 Rio Algom-TVA supply contract and the dropping of two Canadian lawsuits filed by Rio Algom against TVA.

## URANIUM MARKET

Details of which organizations will provide the \$2 million cash payment are not known.

### *Getty—Two Utility Groups*

#### *Two Utility Groups—12 Uranium Companies*

These cases are related in that the same utility groups that are defendants in the first case are plaintiffs in the second. During March, it was announced in Judge Prentice Marshall's Chicago court that the New England utility group (Public Service Co. of New Hampshire and the other owners of the Seabrook nuclear project) had reached agreement in principle to settle with Getty, and that, should the settlement be finalized, the New England group would withdraw from the suit against the 12 Uranium Companies. Presumably this would also involve settlement of Getty's suit against the New England group and that group's counterclaim against Getty. While settlement is anticipated, it had not been finalized as of this writing.

Such a settlement would leave only the Wisconsin utility group involved in each suit.

### *Washington Public Power Supply System—(WPPSS)—Exxon Nuclear Corp.*

WPPSS and Exxon were unable to resolve their difficulties which were reported last month. Consequently, WPPSS has filed suit against Exxon with respect to 1971 and 1973 contracts under which Exxon was to provide uranium (10-14 million pounds U<sub>3</sub>O<sub>8</sub>) and fuel fabrication services to WPPSS units 2 and 3.

Contention: WPPSS seeks a determination that the contracts are valid and enforceable. Exxon contends that, due to schedule delays of up to six years and major alterations in the two units, the contracts are no longer valid.

Status: Suit recently filed. Earliest possible trial date is estimated to be in 1985.

### *Exxon Nuclear Corp.—Alabama Power Co.*

This recently filed suit involves Exxon and Alabama Power, a subsidiary of the Southern Co. At issue is a supply agreement under which certain quantities of uranium have yet to be delivered.

Contention: Exxon seeks a declaratory judgment that either it has no obligations to deliver certain quantities under the contract or that the contract terms should be reformed to adjust the price.

Status: Suit recently filed. Alabama Power has not responded as of this writing.

## AUSTRALIA

There are indications that Australian producers have recently concluded sales contracts, the terms and conditions of which will probably yield higher prices than contracts recently signed by other sellers. Whether this situation will continue remains to be seen; however, the condition suggests that there may be reasons why buyers have been willing to pay higher prices to receive Australian uranium. One apparent reason is that these buyers want to encourage Australian production as another source of uranium supply, since the value to these buyers of diversified supply exceeds the incremental additional cost of the uranium. Ownership is another probable factor since some of these buyers may also be shareholders of projects in Australia and are protecting their interests against the declining price. The question remains, however, that given the current strong buyers' market, why would the buyers not hold out for the same contract terms as other sellers are offering?

There may be additional explanations. Government policies may have influenced some of the buyers to conclude these contracts. In Japan, for example, there is an apparent belief that in the long term, its raw materials will come more from Australia than Canada. The willingness of Japanese buyers to pay higher prices for uranium may therefore be part of a larger plan to obtain other raw materials under long term contract as well.

Safeguards may also be the subject of government policy influencing procurement. Some buyers view current Canadian safeguards requirements as more burdensome than those of Australia, and the lesser burden of Australian safeguards may help justify a higher price. Also, Canada has in the past interrupted uranium shipments for safeguards reasons. Some buyers view this as a more negative factor influencing security of supply than the uncertainty created by the recent safeguards debate in Australia.

On the other hand, Australian labor problems, especially concerning uranium, might be perceived by some buyers as a negative factor relative to Canada and other suppliers. A strike by the Queensland Mines Ltd. work force has very recently affected operations at Nabarlek with the staff required to run

## URANIUM MARKET

the plant. Additionally, dock workers and seaman's unions are blocking uranium concentrate shipments from Darwin and other Australian ports as of this writing.

A change in Australian public sentiment concerning the uranium industry is apparent in a recently released public opinion poll which showed that opposition there to the overseas sale of uranium has increased from 29 to 43 percent over the past five years. The effect on perceived security of supply of both labor problems and increased public opposition has yet to be monitored.

Meanwhile, Australia signed a nuclear safeguards agreement with Sweden on March 18, 1981. Australia holds similar agreements with Finland, the Philippines, the U.S., the U.K., France, Canada and the Republic of Korea.

The potential for long term uranium trade between Australia and Egypt was discussed in a meeting between Doug Anthony, the Deputy Prime Minister of Australia, and President Anwar Sadat last month. Egypt plans to have its first reactor finished by 1990 and has indicated interest in depending on Australia for a substantial amount of its uranium needs.

## CANADA

The Key Lake Board of Inquiry's final report regarding resource development in the Key Lake area of Saskatchewan has been delivered to the Minister of the Environment. Nuexco Report 151 presented a summary of the development itself as presented by the Board. Following is an overview of the conclusions reached by the Board regarding the economics of the project and its environmental impact.

The Key Lake Mining Corp. (KLMC) plans to produce between eight and 12 million pounds of U<sub>3</sub>O<sub>8</sub> per year for at least fifteen years. At least 150 million pounds of U<sub>3</sub>O<sub>8</sub> will be produced during the life of the mine. The production will be divided between the partners in KLMC according to their interests. Saskatchewan Mining Development Corp. (SMDC) has a 50 percent interest in KLMC and accordingly will receive half of the product. Uranerz Canada Ltd. owns a one-third interest and Eldor Resources Ltd. owns one-sixth.

The Board acknowledged that the probable price of

uranium in the future is difficult to accurately judge. Taking a figure somewhere in the middle of the ranges which were presented to them, the Board judged that the total value of Key Lake production during the period under consideration would be between six and eight billion dollars (Canadian).

According to the Board, the Province of Saskatchewan will receive revenues from this production comprised of royalties, corporate income and other taxes, and an increased cash flow to SMDC. The Board estimates that over the life of the mine, total provincial revenues are likely to be between 3.38 billion and 4.20 billion dollars. Royalties to be collected are estimated at between 1.69 and 2.00 billion dollars. Corporate income and other taxes will probably total 120 and 360 million dollars. The increment to the cash flow of SMDC will likely be between 1.56 and 1.86 billion dollars.

During the entire project life, slightly more than one billion dollars of capital and operating expenditures will be made on this project, including annual wages of about 35 million dollars during construction and 11 million to 15 million dollars during production.

Biological studies were done by KLMC to assess the plants, animals, birds and aquatic life that could be affected by the project. These studies did not predict any significant long term consequences. There are unavoidable impacts that were noted. However, the Board was satisfied that these impacts were not significant. They would be local and short term in nature and would not extend beyond the life of the project.

The Board found the measures proposed by KLMC to be adequate to protect environmental quality and to safeguard occupational health and safety. The measures would meet the requirements of Canadian and Saskatchewan law, regulations and policies. The Board expects that the recommendations contained in its report will provide a basis for the conditions under which the project may proceed.

## EUROPE

The European Economic Community (EEC) Commission on Energy presented a report to its Council of Ministers advocating a nuclear energy option for member nations. Recalling the 1974 oil embargo's effect on the Western European economy, the report

## URANIUM MARKET

inged a ten percent reduction in oil consumption for electrical generation to be offset by an increase in nuclear generated electricity. The report went on to discuss the cost of nuclear generated electricity versus coal and oil fired plants and found that current high and unstable interest rates have narrowed what was previously a substantial cost differential in favor of nuclear power plants.

At the end of 1981 France will become the second ranking country in terms of nuclear installed capacity. With the scheduled operation of nine new units in 1981, France will overtake Japan and trail only the United States. The French domestic program is to bring on line one unit every two months until 1988.

### FAR EAST

The first two months of 1981 saw a continuation of recent excellent operation of Japan's nuclear plants. During January and February, plant availability factors were 78.7 percent and 70.1 percent respectively while utilization rates were 72.9 percent and 69 percent.

At the same time, recognizing that the 1990 goal of 51,000-53,000 MWe nuclear installed capacity is most unlikely under current licensing procedures, responsible Japanese government agencies and utilities are examining ways to accelerate the siting, licensing and review processes that precede actual construction start-up. It is planned to reduce this siting and licensing period by more than two years by beginning safety reviews prior to the final decision to proceed with a particular unit and by reducing or eliminating review processes on the same type reactors and equipment.

As a result of a unique licensing system and shorter construction periods of four to five years, forecasts of Japanese nuclear capacity and uranium demand are more difficult to gauge than in many western countries. In the US it is most unlikely that any reactor not presently identified will be in operation by 1990. In Japan it is clear that a number of reactors will be officially ordered in the 1982-1985 period and will be on line prior to 1990. The exact number will be a function of how efficiently the Japanese can manage their siting and licensing difficulties. While the official goal remains 51,000-53,000 MWe by 1990, most people view even 45,000 MWe as an optimistic

target. However, even if it became apparent that the most optimistic goal was to be approached or attained, it is unlikely that any spurt of new uranium activity would ensue since the Japanese already have a substantial surplus under contract into the 1990's.

A new uranium find in an area south of Seoul has increased Korea's uranium resources by more than 50 percent. The new find, 12.6 million tons, has an average grade about 0.01 percent, equivalent to about 10 million pounds U<sub>3</sub>O<sub>8</sub>. While its resources are not economically exploitable in today's market environment, Korea continues its exploration program in an effort to locate additional and higher grade material.

### UNITED STATES

Uranium producers in the US continue to react to the current market situation with announcements of cutbacks and shutdowns. The heightened awareness of rising world inventory levels coupled with a 40 percent drop in the price of uranium over the past 18 months have forced US producers to adjust to the increasingly unfavorable economic outlook. Nuexco Report 117 presented a US uranium production forecast allowing for the publicly announced reductions and other information available to Nuexco at that time. Estimated US production for 1980 was revised in Report 150 to reflect the fact that the cutbacks and layoffs announced during 1980 had had little effect on 1980 concentrate production levels.

A more current Nuexco estimate of near term US production is contained in the insert to this month's Report. Revisions to the Nuexco production forecast will be made as further announcements are received. A summary of announced cutbacks and shutdowns in the US since August 1980 appears in Table 1.

Alabama Power Co.'s Farley unit 2 became the third reactor to be licensed for full power since Three Mile Island.

Attempting to find a temporary cure for the reactor licensing delays, the US Nuclear Regulatory Commission (NRC) has asked Congress for authority to issue interim licenses for nuclear plants. Under the proposed legislation fuel loading and low power testing of up to five percent would be permitted while public hearings on the plant are still in progress.



## URANIUM MARKET

Table 1  
SUMMARY OF MAJOR US URANIUM PRODUCTION CUTBACKS  
ANNOUNCED SINCE AUGUST, 1980

| Date  | Company                            | Event                                                                                                                                                      |
|-------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8-80  | Kerr-McGee Corp.                   | Shut down two underground mines in Ambrosia Lake. Work force reduced by nine percent.                                                                      |
| 8-80  | Western Nuclear, Inc.              | Closed Sheep 1 underground mine near Jeffrey City, Wyoming. Laid off 138 workers.                                                                          |
| 9-80  | Pathfinder Mines Corp.             | Laid off 10 workers at Big Eagle mine.<br>Laid off 75 workers at Lucky Mc mine.                                                                            |
| 11-80 | Union Carbide Corp.                | Laid off 70 workers at Dove Creek, Colorado underground mine.                                                                                              |
| 11-80 | United Nuclear Corp.               | Closed three small underground mines in the Ambrosia Lake, New Mexico district.                                                                            |
| 12-80 | Rocky Mountain Energy Co.          | Cut back mine and mill operations by 40 percent.                                                                                                           |
| 12-80 | Anaconda Co.                       | Shut down Jackpile open pit operation, laid off about 400 workers.                                                                                         |
| 1-81  | Western Nuclear, Inc.              | Laid off 23 workers at Split Rock Mill near Jeffrey City. Reduced production capacity by 40 percent.                                                       |
| 1-81  | Conoco, Inc.-Pioneer Nuclear Corp. | Cut back 50 percent of Conquista mine and mill operations near Falls City, Texas.                                                                          |
| 1-81  | Cotter Corp.                       | Cut back two-thirds of mining operations near Canon City, Colorado. Only Schwartzwalder mine in Colorado and Thornburg mine near Moab, Utah now operating. |
| 2-81  | Federal American Partners          | Shut down Gas Hills, Wyoming mining operations. Mill to continue to run on stockpile.                                                                      |
| 3-81  | Union Carbide Corp.                | Closed Uravan mill in southwest Colorado for at least six months. Curtailed mine operations at all mines in district.                                      |
| 3-81  | Conoco, Inc.-Wyoming Mineral Corp. | Stopped development work at Crown Point mine.                                                                                                              |
| 3-81  | Petrotomics Co.                    | Laid off 130 workers (approximately one third of the work force) at Shirley Basin mine in Wyoming.                                                         |

## TRANSACTIONS

There are four uranium transactions reported this month. One sale of between 300 thousand and 600 thousand pounds U<sub>3</sub>O<sub>8</sub> occurred from a US utility to a US producer. A spot sale of between 300 thousand and 600 thousand pounds U<sub>3</sub>O<sub>8</sub> took place between a US producer and a European utility. Another transaction of between 100 thousand and 300 thousand

pounds U<sub>3</sub>O<sub>8</sub> took place between a US utility and a European utility. Finally, a long term contract of between four million and seven million pounds U<sub>3</sub>O<sub>8</sub> occurred between a European producer and a utility located in the Far East.

There are also three conversion transactions reported this month. One between a US utility and a

## URANIUM MARKET

European organization involved between 300 thousand and 600 thousand pounds U of conversion. One involved between 600 thousand and one million pounds U of conversion transferred between two US companies. Another sale of conversion services between two US companies involved between one million and three million pounds U of conversion.

## PRICING

The **Exchange Value** as of March 31, 1981 is \$25.00 per pound U<sub>3</sub>O<sub>8</sub>, unchanged from the two previous months. The most important factors considered in the determination of this month's Exchange Value were:

1. More than ten million pounds of concentrates are under negotiation at prices approximately equal to the current Exchange Value.

2. Since last month, Nuexco has received one more indication of a willingness to buy substantial quantities of concentrates (more than one million pounds U<sub>3</sub>O<sub>8</sub>) at current prices, so the market could be described as having firmed somewhat at the \$25.00 level. That indication came from a producer for whom it may be advantageous to buy rather than produce.

3. Nuexco has knowledge of more producers which are considering entering the market as buyers at current price levels.

4. Some sellers are offering at prices somewhat below \$25.00 in quantities which at other times would be significant. However, the quantities being offered are relatively insignificant in today's market.

Material available for sale now with delivery in the near term, as listed in the *Market Opportunities* section of this Report, totals 8.2 million pounds U<sub>3</sub>O<sub>8</sub>. Active inquiries in the same time frame to purchase amount to 2.1 million pounds U<sub>3</sub>O<sub>8</sub>. Available near term supply remains at the highest level in recent years. Approximately 15 percent of this near term material is being offered by primary producers; the balance is being offered by holders of inventory.

The **Transaction Value** declined to \$27.00 per pound U<sub>3</sub>O<sub>8</sub> from last month's level of \$27.20. Only one qualifying transaction took place, a sale from a US producer to a European utility. Only three qualifying transactions accounting for a total of 825,000 pounds U<sub>3</sub>O<sub>8</sub> have taken place in 1981. Con-

sequently the **Transaction Value** is dominated by transactions from the fourth quarter of 1980, when spot prices were significantly higher than the current Exchange Value. As more transactions occur at current prices, the gap between **Transaction Value** and **Exchange Value** can be expected to narrow somewhat.

## CONVERSION

Demand for conversion services continued to be active in the longer term secondary market while supply of conversion services remained at a relatively high level in the near term. As indicated in the *Market Opportunities* section of this Report inquiries to sell conversion services in the near term secondary market totaled 3.3 million pounds U as UFe. Inquiries to purchase conversion services during the same time period amounted to 700 thousand pounds U as UFe.

Most sales of secondary conversion services are structured as swaps: a holder of UFe swapping its converted material for a buyer's concentrates with the buyer paying a fee of additional concentrates or cash for the upgraded material. In both the near and longer term, however, a possible alternative is arising as holders of conversion services have expressed the desire to assign their contracts to buyers. Though potentially simpler in execution, a contract assignment would normally require approval by the primary conversion services supplier.

The **Conversion Value** remained at \$1.20 per pound U as UFe for the third straight month. Three sales of conversion services on the secondary market are reported this month. One between a US utility and a European organization involved between 300 thousand and 600 thousand pounds U of conversion at a price somewhat above the Conversion Value. This price for conversion services was agreed upon several months ago. One transaction involved two US companies in an assignment of a conversion contract at a price close to the Conversion Value. The quantity assigned was between 600 thousand and one million pounds U of conversion. Another transaction involving two US companies was concluded for between one million and three million pounds for delivery over the next five years at a price somewhat above the Conversion Value.



## COMMENTARY

**PRESIDENT REAGAN AND NUCLEAR POWER**

*What will President Reagan attempt?—What can he accomplish?—When?—How?*

The above represents the essence of questions asked by members of the nuclear industry about President Reagan and nuclear power. The transition following the election of a new president is always marked by a sense of euphoria. Election success creates an aura of confidence. Current hopes have yet to clash with political realities. Predictions made during such transitions, therefore, must be viewed with circumspection.

President Reagan's initial priorities, as expected, have focused on domestic economics and foreign policy. A comprehensive energy policy has not yet taken form. The links between energy policy and these broader ends, namely economic and foreign affairs, have yet to be forged.

Nuclear power meanwhile is enchained by its own major problems in the financial, regulatory, judicial, legislative and public acceptance arenas. All three government branches as well as the media are involved. No centralized authority exists which can coordinate and direct the needed changes; a greater sense of shared purpose is required.

President Reagan must address several major topics including: the re-start of new nuclear power plant orders; current plant scheduling delays; the breeder program; reprocessing; waste disposal; and the problem of public leadership and the media. Each is discussed below.

**Major Obstacles**

*A Fundamental Change:* Virtually all revolutionary changes of the past two decades have been "against," not "for" progress. Tasks emerging in such an environment focused on stopping, dismantling, controlling, re-examining and risk-eliminating. Energy programs suffered more than most programs. The Reagan approach is the only broadly positive, progressive thrust involving both a change of mood and substance which has occurred in recent times. A major attempt at reversal of direction is in the offing.

*The Political Problem:* The subject of energy has become increasingly political. Political problems by nature defy simple, logical solutions. Thus, one would have difficulty finding politicians who do not

believe that an energy problem exists, that the US should increase domestic oil production, that the US should reduce foreign dependency and use abundantly available fuels. Yet political practice often runs counter to such aims. Energy companies are attacked, nuclear power is given weak support, politicians fantasize about "soft energy," and other actions are taken having effects virtually opposite to those which all agree are desirable.

*The Public Attitude Problem:* Much of the force of the anti-nuclear power movement depends on a no-growth, anti-progress, anti-free enterprise, anti-capitalism movement. This is not to say that all those opposing nuclear power are a part of that movement. The recent election results have been interpreted by many as a repudiation of this "anti-philosophy" and may lead to a decline in nuclear power opposition. But, even so, enough of the anti-nuclear opposition will remain intact to constitute a formidable obstacle to constructive action.

*The Organization Problem:* On the governmental level, the US nuclear power program suffers from diffused responsibilities and authorities. The most critical organization, the US Nuclear Regulatory Commission (NRC), is in need of structural, procedural and personnel changes. Even after such changes are made, the NRC will suffer from committee-type operation. The reorganization task must, of course, precede implementation of policy.

**The Outlook In  
Major Operating Areas**

*Plants in Operation:* Despite Three Mile Island (TMI) related setbacks, US plants have continued to operate. Although nuclear power constitutes only eight percent of US generating capacity, approximately 11 percent of US electric generation is nuclear. Current average capacity factors of 60 to 65 percent are not greatly different from those achieved before the TMI accident. The plants should be the highest of priorities in order to utilize investments already in place and to pave the way for projects which follow.

*Projects-in-Progress:* The United States has 90 nuclear projects-in-progress ranging from contractual commitments to completed, but unfunded, facilities. Virtually all are proceeding on schedules far longer than originally contemplated with additional delays anticipated. Some, particularly those

## COMMENTARY

less than ten percent complete, are in danger of cancellation.

Delays present two major problems, financial and functional. Consumer fuel costs are \$400 to \$500 million per plant per year more when oil instead of uranium is used. Assurance of electrical supply is needed, especially in industrial areas and regions of growing population.

US projects-in-progress have a value on the order of 100 billion dollars. These plants will save billions of dollars each year in fuel costs when finally in operation, in addition to reducing imported oil requirements. The investment will contribute to, rather than take from, the economy. For these and other reasons, projects-in-progress must receive high priority. Utilities obviously will not invest in new plants if unable to complete and use those already under way.

*New Orders:* The ability of the federal government to *cause* a resurgence of *near term* nuclear power station orders is highly limited. However, the federal government does control licensing, the result of which can make cost and schedule control open ended to the utility. Federal and state governments can prevent or halt plants' operations, with the consequences falling upon private investors. This disincentive associated with nuclear power versus other energy sources is a mounting problem.

Until investigators and management are protected from precipitate government action, new commitments for nuclear plants will not be made. Such protection requires Congressional legislation and Congress is unlikely to act without prodding by the Executive Branch and rising public concern. A realistic hope is that a workable solution will be in place before the end of President Reagan's present term of office. Prospects for orders in the mid-1980's depend upon initiatives in the next year or two.

*The Fast Breeder:* Although the fast breeder is encountering resistance from those controlling the administration's budget, Clinch River will likely proceed. That project can be accelerated by government funding. The project has major symbolic significance since support for Clinch River is viewed as support for nuclear power.

*Reprocessing:* Reprocessing is not an urgent matter except as a contribution to the "waste disposal solution." The cost of reprocessing is not large enough to be prohibitive and may proceed for non-economic

reasons. Whatever the decision, the viability of the light water reactor is not likely to be impacted by the reprocessing issue.

*Waste Disposal:* A solution to the waste disposal problem as viewed by the *public* is essential. Waste disposal is an effective anti-nuclear tool and will remain to plague nuclear power. Nonetheless, the waste disposal program must proceed in *parallel* with the light water reactor program. There is insufficient time for them to proceed in *series*.

## Conclusions

1. President Reagan is well equipped to add vigor to the US nuclear power program. He has the will, the communications ability and the staff support to do so. A revitalization of nuclear power by the mid-1980's will require a strong helmsman and patient public support. The main challenges are tests of will, skill and philosophical wisdom.

2. Nuclear power has reached a watershed. Past concepts governing licensing, financing, ownership, engineering, and other basic considerations may not be suitable for the challenges of the future. Merely repairing the present structure will not be sufficient to revitalize nuclear power. Accordingly, problems facing the Reagan Administration are more than administrative. A whole new future framework for the industry may be required.

The most productive areas for short term concentration are those in which the ownership, financing, operating etc. die is already cast, namely projects-in-progress. Immediate progress can be made with improvements in the licensing process.

3. Operating plants may be less hampered by licensing issues, but one cannot expect an increase in capacity factor of more than five percent. From the standpoint of the uranium industry, this translates to a *potential* increase in consumption of only about one to two million pounds U<sub>3</sub>O<sub>8</sub> annually.

Projects-in-progress are expected to advance more effectively. If the NRC reaches its goal of issuing six operating licenses per year, consumption would accelerate by two to 2.5 million pounds per year. However, utilities have already experienced major start-up delays, while uranium deliveries continue based on original contract schedules. The impact on the market of six new operating licenses per year will be modest for some time. New plant orders before the

## COMMENTARY

mid-1980's are unlikely and cannot, under the best of circumstances, create actual demand during this decade.

4. The uranium industry should, therefore, avoid overexpectations. The positive attitudes of the

Reagan Administration are widely welcomed. Conditions will improve, but only at a rate lower than that which can solve the overproduction problems facing US producers.

## RAW MATERIALS

### URANIUM RESOURCE EVALUATION

#### Introduction

The surge in uranium exploration activity during the period extending from 1968 through 1979 was precipitated by a series of events including: the surge of nuclear reactor sales in 1965-1968; utility industry projections for a seven percent annual increase in power demand; the 1973-1974 oil embargo; and industry projections that a uranium supply shortfall would occur in the late 1970's. As these events affected the industry, the economic potential for controlling uranium resources served to induce numerous mining organizations, electric utility companies and governmental agencies to initiate uranium exploration programs. The result of the widespread exploration activity was a large increase in world uranium resources. In November 1980 Nuexco estimated reasonably assured resources (RAR) at 2,800,000 tonnes U<sub>3</sub>O<sub>8</sub>, an increase from the 635,000 tonnes U<sub>3</sub>O<sub>8</sub> world RAR as of the end of 1967 estimated by the International Atomic Energy Agency (IAEA) and the Organization for Economic Cooperation and Development (OECD).

#### Resource Classification

The Nuexco classification of RAR is consistent with the terminology applied to *uranium resources* by the IAEA and is equivalent to *ore reserves* as reported by the US Department of Energy (USDOE). The resource estimates of the IAEA, USDOE and Nuexco are defined as known quantities of uranium which can be recovered within a given cost range based upon current mining and milling technology. The cost cutoff used in each case is compatible with uranium market conditions at the time the evaluation was made. The 1967 cutoff was based on a forward production cost of US\$10 or less per pound U<sub>3</sub>O<sub>8</sub> (IAEA estimate). The November 1980 estimate by Nuexco was based on a forward production cost of US\$50 or less per pound U<sub>3</sub>O<sub>8</sub>.

Forward cost is defined by the IAEA and USDOE to include all capital and operating expenditures incurred after the date of the ore reserve estimate for building, maintaining and operating new and existing uranium facilities. Sunk costs, interest, return on investment and income taxes are not included. Obviously, economic viability of an ore deposit is dependent upon a U<sub>3</sub>O<sub>8</sub> selling price that is substan-

tially higher than projected forward costs. Nuexco estimates that a ratio of selling price to forward cost of approximately 1.5 to 2.0 is necessary to yield a 15 to 20 percent after tax return on investment.

The classification of uranium resources into forward production cost categories was established in 1961. The US Atomic Energy Commission (USAEC) maintained a forward cutoff cost level of \$8 per pound through 1970. The USAEC revised the forward cost criteria for US RAR into categories of \$6, \$8, \$10 and \$15 per pound U<sub>3</sub>O<sub>8</sub>. The IAEA introduced and maintained forward cost categories of US\$10 and \$15 from 1965 through 1972.

Uranium prices and production costs increased rapidly from 1974 to 1976, resulting in the need to reclassify exploitable RAR into higher cost categories. By the end of 1979, USDOE had established cost categories of \$15, \$30, \$50 and \$100 per pound U<sub>3</sub>O<sub>8</sub> for the US. The IAEA introduced cost categories of US\$30 and \$50 per pound U<sub>3</sub>O<sub>8</sub>. The impact of these production cost increases on RAR was the transfer of low grade reserves into higher cost categories thereby reducing the average ore grade of RAR, and increasing overall RAR. The upper cost cutoff represents the cost at which computed RAR assigned to all categories could be recovered.

#### Present Resource Status

The commercial market for uranium has been seriously affected by steady inflation since 1973 and more recently by an oversupply of uranium concentrate which has depressed spot prices. Thus the current classification of RAR in the \$50 category may now be misleading. The purpose of this essay is to attempt to revise the forward cost cutoff downward to conform with the existing commercial level of property development and market activity.

The present spot market of US\$25 per pound for U<sub>3</sub>O<sub>8</sub> is probably a more appropriate cost cutoff to assess RAR today. Table 2 represents Nuexco's estimate of RAR at a forward cost cutoff of US\$25 per pound of U<sub>3</sub>O<sub>8</sub>. For comparison, Table 2 also tabulates Nuexco's November 1980 RAR estimate of US\$50 or less per pound. The \$25 forward cost category yields estimated RAR of 1,729,000 tonnes U<sub>3</sub>O<sub>8</sub> compared to the \$50 estimate of 2,800,000 tonnes. The breakdown of adjustments in RAR by region follows.

# RAW MATERIALS

Table 2  
SUMMARY OF WORLD URANIUM RESOURCES  
REASONABLY ASSURED AT US\$25 OR LESS  
PER POUND U<sub>3</sub>O<sub>8</sub>—COMPARED TO \$50 OR LESS PER POUND

| Country                  | Resource Classification—Tonnes U <sub>3</sub> O <sub>8</sub> |                                   |
|--------------------------|--------------------------------------------------------------|-----------------------------------|
|                          | \$50.00 Resources<br>(Nov. 1980)                             | \$25.00 Resources<br>(March 1981) |
| Africa:                  |                                                              |                                   |
| South Africa             | 452,000                                                      | 112,000                           |
| Namibia                  | 104,000                                                      | 90,000                            |
| Niger                    | 195,000                                                      | 72,000                            |
| Algeria                  | 33,000                                                       | -0-                               |
| Gabon                    | 24,000                                                       | 24,000                            |
| Israel                   | 36,000                                                       | -0-                               |
| Central African Republic | 9,500                                                        | -0-                               |
| Egypt                    | 5,000                                                        | -0-                               |
| Asia:                    |                                                              |                                   |
| Japan                    | 8,200                                                        | -0-                               |
| India                    | 30,000                                                       | -0-                               |
| Australia                | 165,200                                                      | 395,000                           |
| Europe:                  |                                                              |                                   |
| France                   | 95,600                                                       | 19,000                            |
| Spain                    | 12,500                                                       | -0-                               |
| Portugal                 | 9,000                                                        | -0-                               |
| Sweden                   | 4,200                                                        | -0-                               |
| Greenland (Denmark)      | 32,000                                                       | -0-                               |
| Italy                    | 1,200                                                        | -0-                               |
| Greece                   | 1,000                                                        | -0-                               |
| Yugoslavia               | 8,000                                                        | -0-                               |
| North America:           |                                                              |                                   |
| Canada                   | 279,000                                                      | 232,000                           |
| United States            | 850,000                                                      | 185,000                           |
| Mexico                   | 7,600                                                        | -0-                               |
| South America:           |                                                              |                                   |
| Argentina                | 28,000                                                       | -0-                               |
| Brazil                   | 115,000                                                      | -0-                               |
| Totals                   | 2,800,000                                                    | 1,729,000                         |

*Africa:* RAR in South Africa are related to gold recovery in the Witwatersrand district, to copper recovery at Palabora and to primary uranium deposits in the Karoo sediments. Only the resources assigned to the Karoo sediments have been eliminated in the

\$25 category. In Namibia, RAR in the \$25 category are limited to the Rossing deposit. All undeveloped reserves in Niger were eliminated in the new category; only the Arlit and Akouta RAR remain. All RAR in Gabon are associated with the Oklo and Moumana



## RAW MATERIALS

production centers and are therefore included. Resources in Algeria, Israel, Central Africa Republic and Egypt are excluded.

**Australia:** The large high-grade deposits located in the Northern Territory: Jabiluka, Ranger and Koon-garra; the Yeelirrie deposit in Western Australia and the remaining reserves at the Mary Kathleen mine in Queensland represent RAR of 401,000 tonnes U<sub>3</sub>O<sub>8</sub> available at a \$25 per pound forward cost cutoff. The remaining deposits in the country are excluded. Roxby Downs in South Australia has the potential to be a large uranium resource as a co-product with copper production, however, the deposit is still in the exploration stage and total uranium resources are uncertain and are thus not included in the \$25 category.

**Europe:** It is estimated that less than 20,000 tonnes of RAR in France will remain in the lower forward cost category of \$25, due to the generally low-grade nature of the ore deposits. RAR in Spain, Portugal, Sweden, Greenland, Italy, Greece and Yugoslavia are not included in the \$25 category because the deposits in those countries are generally of low grade. Isolated high-grade ore does exist but not on a scale large enough to support low-cost production.

**North America:** RAR in Canada are limited to the high-grade deposits located in northern Saskatchewan and the high volume operating mines at Elliot Lake. The undeveloped deposits scattered throughout the rest of Canada are all of higher forward cost than \$25.

Reassessment of resources in the United States is difficult and complicated because of the large number

of deposits and the wide distribution of ore grades.

Total RAR for the US in the \$25 forward cost category is estimated at 185,000 tonnes U<sub>3</sub>O<sub>8</sub>, down about 365,000 tonnes from the 1980 estimate by Nuexco done at a \$50 cutoff.

### Other Considerations

World RAR will likely continue to be downgraded as a result of rising operating costs. Since exploration activity is also decreasing, newly discovered reserves may not offset deletions from lower cost categories. This is especially true in the US where low grade deposits have high production costs, and 1980 exploration activities were below the 1979 level by 34 percent. The situation is less severe in Australia and Canada because exploration in both countries continues almost unabated and new discoveries continue to add to resources.

Although all or part of the RAR of many nations are eliminated at the \$25 cutoff, it is still likely that some of those reserves will continue to be exploited for other reasons. For example, several nations have a national interest in producing uranium from domestic resources.

A breakdown of RAR distribution at the \$25 cutoff shows 28 percent available in the US, 23 percent in Australia, 13 percent in Canada, 24 percent for South Africa and 12 percent for the remaining Free World. The distribution of RAR in today's market environment clearly illustrates that the US, presently with over 40 percent of the commercial uranium demand will very likely become more dependent on imported supplies.



# STATISTICAL DATA

## EXCHANGE VALUE—\$25.00 lb U<sub>3</sub>O<sub>8</sub> Determined as of March 31, 1981

### Definition

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

### Derivation

Nuexco bases the Exchange Value upon:

- Data from recently completed transactions.
- Data from pending transactions.
- Firm bids to buy and firm offers to sell.
- Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

### Comments

Nuexco does not consider the following in determining the Exchange Value:

- The price of uranium delivered or to be delivered under old contracts.
- The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

| TRANSACTION VALUE<br>Determined as of March 31, 1981 |                    |                              |                  |
|------------------------------------------------------|--------------------|------------------------------|------------------|
| \$ lb U <sub>3</sub> O <sub>8</sub>                  | Millions of Pounds | Number<br>of<br>Transactions | Number of Months |
| 27.00                                                | 3.3                | 11                           | 6                |

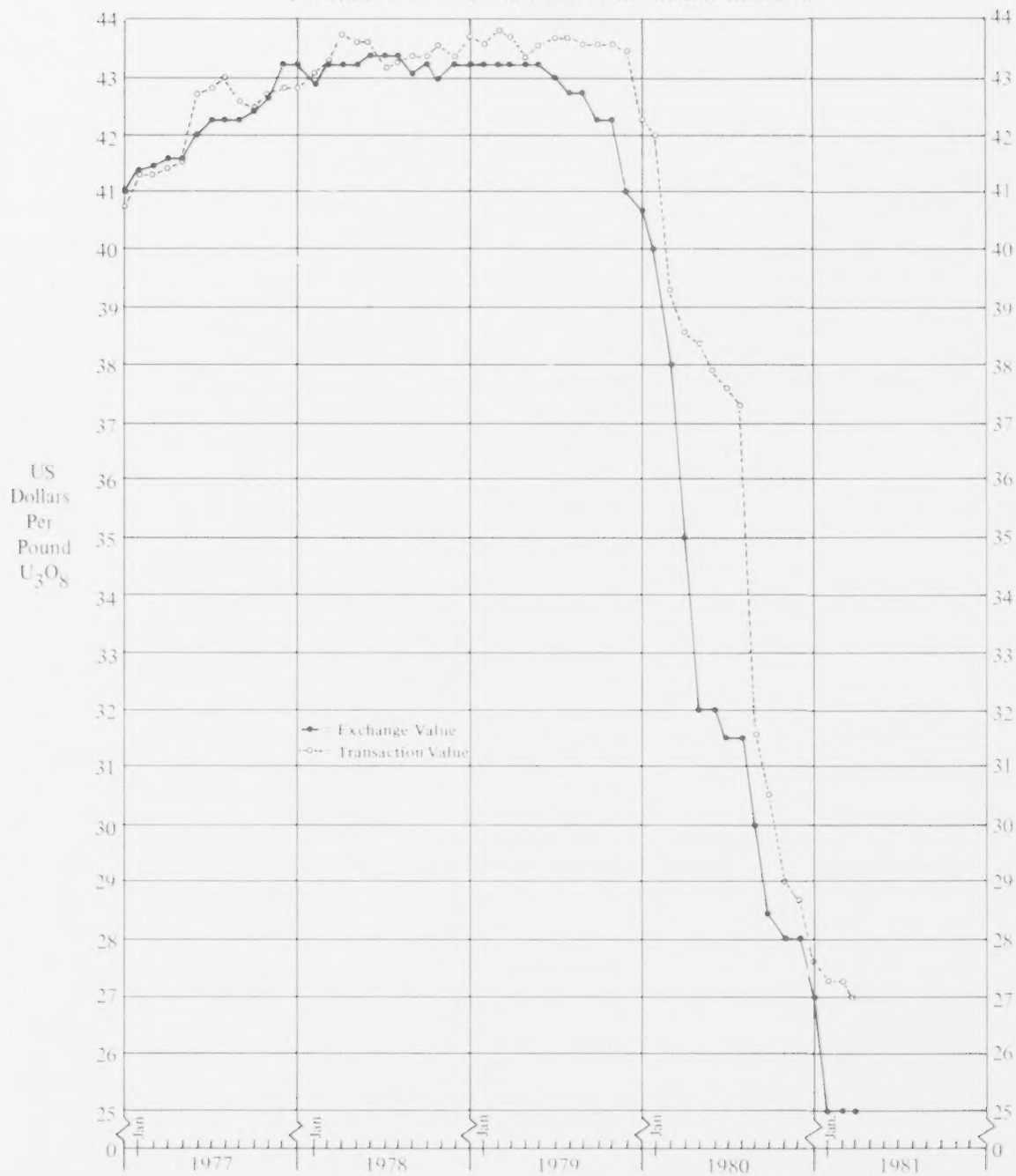
### Definition

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U<sub>3</sub>O<sub>8</sub> in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds U<sub>3</sub>O<sub>8</sub> are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

STATISTICAL DATA

EXCHANGE AND TRANSACTION VALUES  
SINCE JANUARY 1977

Determined as of the last day of the month indicated



## STATISTICAL DATA

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U.O.s)

|      | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1968 |       |       |       |       |       |       |       | 6.35  | 6.35  | 6.40  | 6.45  | 6.50  |
| 1969 |       | 6.35  | 6.10  | 6.10  | 6.25  | 6.25  | 6.20  | 6.20  | 6.15  | 6.15  | 6.15  | 6.20  |
| 1970 | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.30  | 6.20  | 6.15  | 6.15  | 6.15  | 6.15  |
| 1971 | 6.20  | 6.20  | 6.20  | 6.20  | 6.15  | 6.05  | 6.00  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  |
| 1972 | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  | 5.95  |
| 1973 | 5.95  | 6.00  | 6.10  | 6.20  | 6.45  | 6.50  | 6.50  | 6.50  | 6.50  | 6.50  | 6.75  | 7.00  |
| 1974 | 7.70  | 7.90  | 8.00  | 9.00  | 9.50  | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 |       |       |       |       |       |       |       |       |       |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U.O.s)

|      | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1976 |       |       |       |       | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 |       |       |       |       |       |       |       |       |       |

EXCHANGE VALUE EXPRESSED IN SELECTED  
PRODUCER & CONSUMER CURRENCIES\*

| Country             | per lb U.O.s<br>in Concentrates | per kg U.O.s<br>in Concentrates | per kg U<br>in Concentrates |
|---------------------|---------------------------------|---------------------------------|-----------------------------|
| US (dollar)         | 25.00                           | 55.11                           | 64.99                       |
| France (franc)      | 122.24                          | 269.51                          | 317.82                      |
| FRG (mark)          | 51.91                           | 114.44                          | 134.95                      |
| Japan (yen)         | 5.272                           | 11.623                          | 13.706                      |
| Switzerland (franc) | 47.36                           | 104.42                          | 123.14                      |
| UK (pound)          | 11.14                           | 24.57                           | 28.97                       |
| Australia (dollar)  | 21.48                           | 47.35                           | 55.84                       |
| Canada (dollar)     | 29.72                           | 65.53                           | 77.28                       |
| Niger, Gabon (CFA)  | 6.112                           | 13.476                          | 15.891                      |
| South Africa (rand) | 19.96                           | 44.02                           | 51.91                       |

\*Calculated using currency exchange rates published in the Wall Street Journal on the last business day of the month.

*STATISTICAL DATA*

**LOAN USE CHARGE RATE—7.0% year**

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

- A. Data from recently completed or pending loan transactions.
- B. Rates included in firm proposals to borrow or lend.
- C. Rates that potential borrowers and lenders have expressed a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

**CONVERSION VALUE—\$1.20 lb. U as UF<sub>6</sub>**  
Determined as of March 31, 1981

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near term transactions for significant quantities of conversion services could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

- A. Data from recently completed transactions.
- B. Data from pending transactions.
- C. Firm bids to buy and firm offers to sell.
- D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

- A. The price of conversion services delivered or to be delivered under old contracts.
- B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

## STATISTICAL DATA

## CURRENT TRANSACTIONS\*

| Nuexco Reference Number     | Delivery Period | Approximate Quantity (thousands of pounds, U <sub>3</sub> O <sub>8</sub> equivalent) | Approximate Price as percent of Current E.V. | Seller Group | Buyer Group | Remarks                              |
|-----------------------------|-----------------|--------------------------------------------------------------------------------------|----------------------------------------------|--------------|-------------|--------------------------------------|
| <b>Uranium Transactions</b> |                 |                                                                                      |                                              |              |             |                                      |
| 1425                        | 81              | 301 - 600                                                                            | —                                            | US           | US          | Price related to market              |
| 1427                        | 81              | 301 - 600                                                                            | 102                                          | US           | Europe      |                                      |
| 1448                        | 81              | 101 - 300                                                                            | —                                            | US           | Europe      |                                      |
| 1455                        | 85 - 94         | 4001 - 7001                                                                          | —                                            | Europe       | Far East    | Definitive price information unknown |

## Conversion Transactions

|       |           |             |     |    |        |  |
|-------|-----------|-------------|-----|----|--------|--|
| 1399  | 81 and 83 | 601 - 1000  | 100 | US | US     |  |
| 1423A | 81        | 301 - 600   | 135 | US | Europe |  |
| 1469  | 81 - 85   | 1001 - 3000 | 125 | US | US     |  |

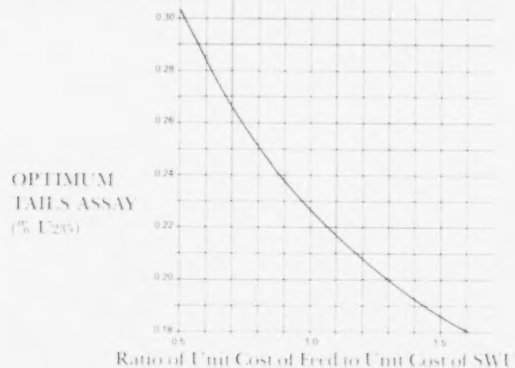
\*Transactions listed include not only those in which Nuexco was involved, but also all others of which Nuexco is aware.

STATISTICAL DATA

OPTIMUM TAILS ASSAY

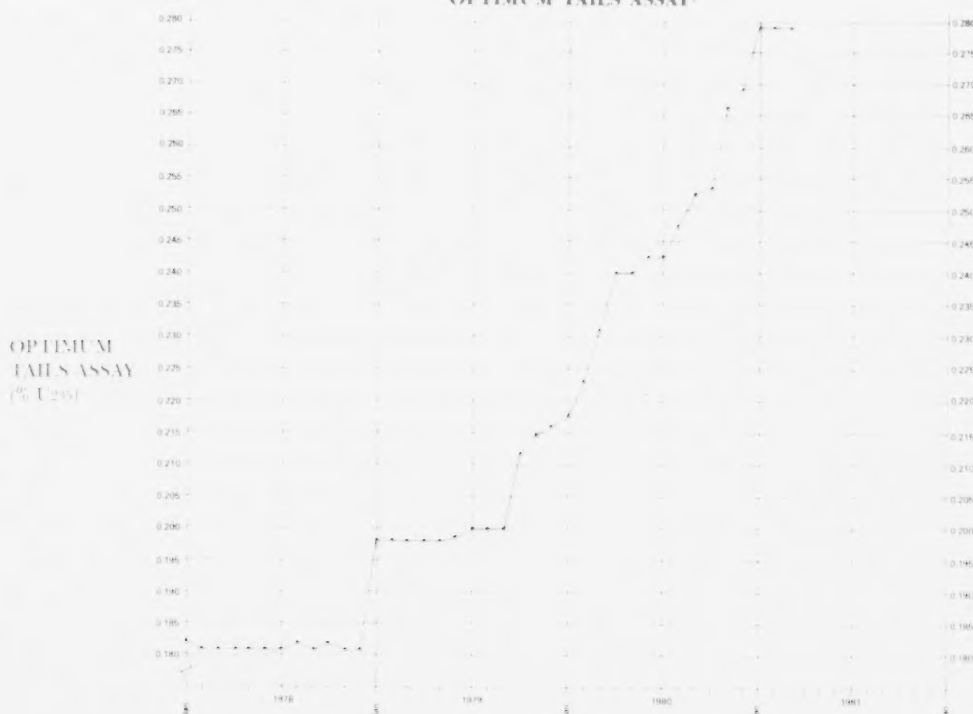
The optimum tails assay is the tails composition at which the cost of enriched uranium is lowest for given costs of separative work (SWU) and natural uranium feed. It depends only on the ratio of the cost of a kilogram of natural uranium in the form of U<sub>6</sub> to the cost of a kilogram unit of separative work. The US Department of Energy (USDOE) Adjustable Fixed Commitment (AFC) enrichment contract holders have the option, within limits, to specify the transaction tails assay. The transaction tails assay for USDOE Requirements contracts is 0.2 percent U<sub>235</sub>. For every one-hundredth of one percent increase in the transaction tails assay, uranium consumption increases about two percent.

TAILS ASSAY FOR MINIMUM COST OF PRODUCT\*



\*From Nuexco Report 138

OPTIMUM TAILS ASSAY<sup>1</sup>



<sup>1</sup>Based on Exchange Value and USDOE AFC SWU price, interpolated to the nearest thousandth.



## STATISTICAL DATA

## US GOVERNMENT STATISTICS

|                                 | Producer Price<br>Index—Industrial<br>Commodities<br>(1967 = 100) <sup>1</sup> | Consumer<br>Price<br>Index<br>(1967 = 100) <sup>2</sup> | GNP<br>Implicit<br>Price<br>Deflator<br>(1972 = 100) <sup>3</sup> | Gross Average Hourly Earnings<br>of Production or Non-supervisory<br>Workers (US\$) <sup>4</sup> |                                               |                                                 |
|---------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------|
|                                 |                                                                                |                                                         |                                                                   | Metal<br>Mining<br>(SIC 10)                                                                      | Primary<br>Non-ferrous<br>Metals<br>(SIC 333) | Chemicals<br>and Allied<br>Products<br>(SIC 28) |
| Annual Avg. 1970 <sup>(5)</sup> | 110.0                                                                          | 116.3                                                   | 91.36                                                             | 3.88                                                                                             | 3.87                                          | 3.69                                            |
| Annual Avg. 1971 <sup>(5)</sup> | 114.1                                                                          | 121.3                                                   | 96.02                                                             | 4.12                                                                                             | 4.15                                          | 3.97                                            |
| Annual Avg. 1972 <sup>(5)</sup> | 117.9                                                                          | 125.3                                                   | 100.00                                                            | 4.56                                                                                             | 4.59                                          | 4.26                                            |
| Annual Avg. 1973 <sup>(5)</sup> | 125.9                                                                          | 133.1                                                   | 105.80                                                            | 4.84                                                                                             | 4.98                                          | 4.51                                            |
| Annual Avg. 1974 <sup>(5)</sup> | 153.8                                                                          | 147.7                                                   | 116.02                                                            | 5.44                                                                                             | 5.63                                          | 4.88                                            |
| Annual Avg. 1975 <sup>(5)</sup> | 171.5                                                                          | 161.2                                                   | 127.15                                                            | 6.13                                                                                             | 6.24                                          | 5.39                                            |
| Annual Avg. 1976 <sup>(5)</sup> | 182.4                                                                          | 170.5                                                   | 133.71                                                            | 6.76                                                                                             | 6.87                                          | 5.91                                            |
| Annual Avg. 1977 <sup>(6)</sup> | 195.1                                                                          | 181.5                                                   | 141.70                                                            | 7.28                                                                                             | 7.67                                          | 6.43                                            |
| Annual Avg. 1978 <sup>(6)</sup> | 209.4                                                                          | 195.4                                                   | 152.05                                                            | 8.23                                                                                             | 8.56                                          | 7.02                                            |
| Annual Avg. 1979 <sup>(6)</sup> | 236.5                                                                          | 217.4                                                   | 165.46                                                            | 9.27                                                                                             | 9.49                                          | 7.60                                            |
| Dec 1979                        | 253.1                                                                          | 229.9                                                   | 170.58                                                            | 9.80                                                                                             | 9.92                                          | 7.92                                            |
| Jan 1980                        | 260.6                                                                          | 233.2                                                   | —                                                                 | 9.91                                                                                             | 10.06                                         | 7.97                                            |
| Feb 1980                        | 265.9                                                                          | 236.4                                                   | —                                                                 | 9.92                                                                                             | 10.01                                         | 8.01                                            |
| Mar 1980                        | 268.6                                                                          | 239.8                                                   | 174.48                                                            | 9.90                                                                                             | 10.22                                         | 8.05                                            |
| Apr 1980                        | 271.3                                                                          | 242.5                                                   | —                                                                 | 10.00                                                                                            | 10.30                                         | 8.12                                            |
| May 1980                        | 271.9                                                                          | 244.9                                                   | —                                                                 | 10.18                                                                                            | 10.37                                         | 8.17                                            |
| Jun 1980                        | 273.5                                                                          | 247.6                                                   | 178.93                                                            | 10.13                                                                                            | 10.69                                         | 8.24                                            |
| Jul 1980                        | 276.2                                                                          | 247.8                                                   | —                                                                 | 10.24                                                                                            | 10.82                                         | 8.35                                            |
| Aug 1980                        | 278.2                                                                          | 249.4                                                   | —                                                                 | 10.38                                                                                            | 10.78                                         | 8.39                                            |
| Sep 1980                        | 278.8                                                                          | 251.7                                                   | 182.92                                                            | 10.54                                                                                            | 10.94                                         | 8.46                                            |
| Oct 1980                        | 281.2                                                                          | 253.9                                                   | —                                                                 | 10.58                                                                                            | 11.00                                         | 8.52                                            |
| Nov 1980                        | 282.7P                                                                         | 254.2R                                                  | —                                                                 | 10.73                                                                                            | 11.06                                         | 8.59                                            |
| Dec 1980                        | 286.1P                                                                         | 258.4                                                   | 183.98                                                            | 10.86                                                                                            | 11.31                                         | 8.68                                            |
| Jan 1981                        | 289.9P                                                                         | 260.5                                                   | —                                                                 | 10.93P                                                                                           | 11.42P                                        | 8.71P                                           |
| Feb 1981                        | 294.8P                                                                         | 263.2                                                   | —                                                                 | —                                                                                                | —                                             | —                                               |

P = Preliminary R = Revised since last month

(1) US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

(2) US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

(3) US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

(4) US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for January 1977 and beyond are adjusted to the March 1979 benchmark.

(5) Data for 1970-1976, monthly except for the GNP Implicit Price Deflator, and Price Index data for 1977-1978 appear on pages 16-18 of Nuexco Report 139.

(6) Employment and Earnings data for 1977-1979, monthly, appear on page 33 of Nuexco Report 147.

STATISTICAL DATA

AUSTRALIAN GOVERNMENT STATISTICS

|                                 | Price Index of Materials<br>Used in Manufacturing<br>Industry—All Groups<br>(Year 1968-69 = 100.0) <sup>1</sup> | Weighted Average<br>Minimum Weekly Wage<br>Rates—Adult Males<br>Australia<br>Mining and Quarrying (AS) <sup>2</sup> |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Annual Avg. 1970 <sup>(3)</sup> | 101.4                                                                                                           | 59.88                                                                                                               |
| Annual Avg. 1971 <sup>(3)</sup> | 101.5                                                                                                           | 65.95                                                                                                               |
| Annual Avg. 1972 <sup>(3)</sup> | 105.6                                                                                                           | 71.26                                                                                                               |
| Annual Avg. 1973 <sup>(3)</sup> | 124.4                                                                                                           | 78.96                                                                                                               |
| Annual Avg. 1974 <sup>(3)</sup> | 141.9                                                                                                           | 108.07                                                                                                              |
| Annual Avg. 1975 <sup>(3)</sup> | 150.4                                                                                                           | 132.55                                                                                                              |
| Annual Avg. 1976 <sup>(3)</sup> | 168.4                                                                                                           | 160.93                                                                                                              |
| Annual Avg. 1977 <sup>(3)</sup> | 192.0                                                                                                           | 179.03                                                                                                              |
| Annual Avg. 1978 <sup>(3)</sup> | 215.4                                                                                                           | 190.04                                                                                                              |
| Annual Avg. 1979                | 248.5                                                                                                           | 196.34                                                                                                              |
| Sep 1979                        | 302.4                                                                                                           | 202.24                                                                                                              |
| Oct 1979                        | 309.4                                                                                                           | 201.71                                                                                                              |
| Nov 1979                        | 310.4                                                                                                           | 201.05                                                                                                              |
| Dec 1979                        | 319.4                                                                                                           | 201.85                                                                                                              |
| Jan 1980                        | 340.1                                                                                                           | 215.72                                                                                                              |
| Feb 1980                        | 345.6                                                                                                           | 215.18                                                                                                              |
| Mar 1980                        | 340.3                                                                                                           | 214.81                                                                                                              |
| Apr 1980                        | 327.9                                                                                                           | 215.12                                                                                                              |
| May 1980                        | 335.1                                                                                                           | 214.79                                                                                                              |
| Jun 1980                        | 338.4                                                                                                           | 214.12                                                                                                              |
| Jul 1980                        | 349.1                                                                                                           | 221.41                                                                                                              |
| Aug 1980                        | 353.2                                                                                                           | 219.70                                                                                                              |
| Sep 1980                        | 351.6                                                                                                           | 219.21R                                                                                                             |
| Oct 1980                        | 349.5R                                                                                                          | 220.48                                                                                                              |
| Nov 1980                        | 351.7R                                                                                                          | 220.85P                                                                                                             |
| Dec 1980                        | 353.0P                                                                                                          | 221.18P                                                                                                             |
| Jan 1981                        | 359.1P                                                                                                          |                                                                                                                     |

P = Preliminary R = Revised since last month

(1) Australian Bureau of Statistics, Canberra; "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

(2) Australian Bureau of Statistics, Canberra; "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest fourteen months shown are subject to revision.

(3) Monthly data for 1970 through 1978 appear on pages 47 and 48 of Nuexco Report 138.

## STATISTICAL DATA

## CANADIAN GOVERNMENT STATISTICS

|                  | Industry Selling<br>Price Index:<br>Manufacturing<br>(D 500000) <sup>1,2</sup><br>(1971 = 100.0) | Wage-earner Data:<br>Average Hourly Earnings (C\$) <sup>3,4</sup> |                                                               |                                                         |
|------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------|
|                  |                                                                                                  | Metal Mining,<br>including<br>milling<br>(SIC: 050-059)           | Primary Metal<br>Industries,<br>non-ferrous<br>(SIC: 296-298) | Chemicals and<br>Chemical<br>Products<br>(SIC: 370-379) |
| Annual Avg. 1977 | 174.3                                                                                            | 8.18                                                              | 6.50                                                          | 6.51                                                    |
| Annual Avg. 1978 | 190.4                                                                                            | 8.76                                                              | 6.82                                                          | 6.97                                                    |
| Annual Avg. 1979 | 217.9                                                                                            | 9.60                                                              | 7.35                                                          | 7.67                                                    |
| Oct 1979         | 227.4                                                                                            | 9.89                                                              | 7.54                                                          | 7.88                                                    |
| Nov 1979         | 228.1                                                                                            | 9.97                                                              | 7.61                                                          | 7.91                                                    |
| Dec 1979         | 230.4                                                                                            | 9.93                                                              | 7.51                                                          | 7.89                                                    |
| Jan 1980         | 239.0                                                                                            | 9.96                                                              | 7.57                                                          | 7.99                                                    |
| Feb 1980         | 240.8                                                                                            | 10.11                                                             | 7.69                                                          | 8.08                                                    |
| Mar 1980         | 239.5                                                                                            | 10.34                                                             | 7.83                                                          | 8.26                                                    |
| Apr 1980         | 241.1                                                                                            | 10.40                                                             | 7.94                                                          | 8.36                                                    |
| May 1980         | 242.4                                                                                            | 10.50                                                             | 8.01                                                          | 8.44                                                    |
| Jun 1980         | 243.7                                                                                            | 10.51                                                             | 8.07                                                          | 8.46                                                    |
| Jul 1980         | 246.3                                                                                            | 10.49                                                             | 8.11                                                          | 8.55                                                    |
| Aug 1980         | 249.3                                                                                            | 10.58                                                             | 8.14                                                          | 8.65                                                    |
| Sep 1980         | 252.0R                                                                                           | 10.85                                                             | 8.24                                                          | 8.71                                                    |
| Oct 1980         | 255.8R                                                                                           | 11.05                                                             | 8.28                                                          | 8.82                                                    |
| Nov 1980         | 257.5R                                                                                           | 11.11R                                                            | 8.38R                                                         | 8.77R                                                   |
| Dec 1980         | 257.8R                                                                                           | 11.07P                                                            | 8.35P                                                         | 9.01P                                                   |
| Jan 1981         | 261.1P                                                                                           |                                                                   |                                                               |                                                         |

P = Preliminary R = Revised since last month

(1) Statistics Canada, Prices Division, Ottawa, "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

(2) Monthly data for 1973 through 1978 appear on page 4.10 of Nuxco Report 138.

(3) Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa, "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

(4) Monthly data for 1977 and 1978 appear on page 4.11 of Nuxco Report 138.

STATISTICAL DATA

REPUBLIC OF SOUTH AFRICA STATISTICS

|                                 | Average Declared Working<br>Costs per Metric Ton of<br>Gold Ore Milled (Rand) <sup>(1)</sup> | Consumer<br>Price Index <sup>(2)</sup><br>(1975 = 100, except where<br>otherwise indicated) | Wholesale<br>Price Index<br>All Groups<br>(1975 = 100) |
|---------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Annual Avg. 1970 <sup>(3)</sup> | 7.34                                                                                         | 100.3 <sup>(4)</sup>                                                                        |                                                        |
| Annual Avg. 1971 <sup>(3)</sup> | 7.88                                                                                         | 106.4 <sup>(4)</sup>                                                                        | 59.1                                                   |
| Annual Avg. 1972 <sup>(3)</sup> | 8.79                                                                                         | 113.3 <sup>(4)</sup>                                                                        | 63.9                                                   |
| Annual Avg. 1973 <sup>(3)</sup> | 10.51                                                                                        | 124.1 <sup>(4)</sup>                                                                        | 72.3                                                   |
| Annual Avg. 1974 <sup>(3)</sup> | 13.18                                                                                        | 138.5 <sup>(4)</sup>                                                                        | 85.3                                                   |
| Annual Avg. 1975 <sup>(3)</sup> | 16.71                                                                                        | 157.2 <sup>(4)</sup>                                                                        | 100.0                                                  |
| Annual Avg. 1976 <sup>(3)</sup> | 19.30                                                                                        | 174.7 <sup>(4)</sup>                                                                        | 115.1                                                  |
| Annual Avg. 1977 <sup>(3)</sup> | 23.87                                                                                        | 194.4 <sup>(4)</sup>                                                                        | 130.0                                                  |
| Annual Avg. 1978 <sup>(3)</sup> | 27.14                                                                                        | 137.2                                                                                       | 142.7                                                  |
| Annual Avg. 1979 <sup>(3)</sup> | 30.18                                                                                        | 155.3                                                                                       | 164.5                                                  |
| Annual Avg. 1980                | 35.53                                                                                        | 176.7                                                                                       | 192.1                                                  |
| Dec 1979                        | 31.89                                                                                        | 164.0                                                                                       | 176.8                                                  |
| Jan 1980                        |                                                                                              | 165.4                                                                                       |                                                        |
| Feb 1980                        |                                                                                              | 167.0                                                                                       | 178.3                                                  |
| Mar 1980                        | 33.65                                                                                        | 168.0                                                                                       | 180.5                                                  |
| Apr 1980                        |                                                                                              | 170.0                                                                                       | 181.7                                                  |
| May 1980                        |                                                                                              | 171.9                                                                                       | 184.2                                                  |
| Jun 1980                        | 34.48                                                                                        | 174.6                                                                                       | 187.0                                                  |
| Jul 1980                        |                                                                                              | 177.2                                                                                       | 189.0                                                  |
| Aug 1980                        |                                                                                              | 179.2                                                                                       | 192.7                                                  |
| Sep 1980                        | 36.19                                                                                        | 182.8                                                                                       | 196.8                                                  |
| Oct 1980                        |                                                                                              | 186.3                                                                                       | 199.8                                                  |
| Nov 1980                        |                                                                                              | 187.8                                                                                       | 203.1                                                  |
| Dec 1980                        |                                                                                              | 189.9                                                                                       | 205.6                                                  |
|                                 |                                                                                              |                                                                                             | 206.5                                                  |
| Jan 1981                        |                                                                                              | 191.0                                                                                       | 207.2                                                  |
| Feb 1981                        |                                                                                              | 193.8                                                                                       |                                                        |

(1) Chamber of Mines of South Africa, Johannesburg, "Analysis of Working Results," published quarterly.

(2) Republic of South Africa Department of Statistics, Pretoria, "Government Gazette," Consumer Price Index for Urban Areas.

(3) Historical data for the Average Declared Working Costs and Consumer Price Index, 1970-1979 appear on page 19 of Nuenco Report 110.

(4) April 1970 = 100.00.

# MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

## URANIUM SUPPLY

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U <sub>3</sub> O <sub>8</sub> ) |              |              | Remarks         |
|-------------------------------|--------------------------------------------------------------------------|--------------|--------------|-----------------|
|                               | 0 to 1 Year                                                              | 1 to 2 Years | 2 to 3 Years |                 |
| Available for Sale:           |                                                                          |              |              |                 |
| 1392                          | 400                                                                      |              |              |                 |
| 1393                          | 60                                                                       | 175          | 175          | Long term       |
| 1475                          | 1000                                                                     |              |              | UF <sub>6</sub> |
| 1480                          | 300                                                                      |              |              |                 |
| 1490                          | 1250                                                                     |              |              |                 |
| 1540                          | 700                                                                      |              |              | UF <sub>6</sub> |
| 1550                          | 1550                                                                     | 1050         |              |                 |
| 1552                          | 600                                                                      |              |              |                 |
| 1562                          |                                                                          | 150          | 150          | Long term       |
| 1564                          | 20                                                                       |              |              |                 |
| 1575                          |                                                                          | 500          | 500          | Long term       |
| 1576                          | 250                                                                      |              |              |                 |
| 1581                          | 100                                                                      | 150          | 150          | Long term       |
| 1595                          | 600                                                                      |              |              |                 |
| 1600                          |                                                                          |              | 200          | Long term       |
| 1610                          | 50                                                                       |              |              |                 |
| 1615                          | 400                                                                      |              |              |                 |
| 1627                          | 1000                                                                     |              |              | UF <sub>6</sub> |
| TOTALS                        | 8280                                                                     | 2025         | 1175         |                 |

## Available for Loan:

|        |      |  |  |                 |
|--------|------|--|--|-----------------|
| 1429   | 700  |  |  | UF <sub>6</sub> |
| 1492   | 900  |  |  | UF <sub>6</sub> |
| 1602   | 400  |  |  |                 |
| TOTALS | 2000 |  |  |                 |

\*Measured from the date of this Report.

# MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

## URANIUM DEMAND

| Nuenco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U <sub>3</sub> O <sub>8</sub> ) |              |              | Remarks   |
|-------------------------------|--------------------------------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                                              | 1 to 2 Years | 2 to 3 Years |           |
| Inquiries to Purchase:        |                                                                          |              |              |           |
| 1423                          | 1000                                                                     | 1000         |              |           |
| 1459                          |                                                                          |              | 200          | Long term |
| 1462                          |                                                                          |              | 100          | Long term |
| 1514                          | 400                                                                      |              |              |           |
| 1529                          |                                                                          |              | 550          | Long term |
| 1587                          |                                                                          | 275          | 275          | Long term |
| 1603                          | 100                                                                      | 100          | 100          | Long term |
| 1634                          |                                                                          | 400          | 400          |           |
| 1636                          | 465                                                                      | 850          | 900          |           |
| 1640                          | 150                                                                      |              |              |           |
| TOTALS                        | 2115                                                                     | 2625         | 2525         |           |
| Inquiries to Borrow:          |                                                                          |              |              |           |
| 1621                          | 300                                                                      |              |              |           |
| TOTAL                         | 300                                                                      |              |              |           |

\*Measured from the date of this Report.



# MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the secondary market for U<sub>F</sub> conversion services. The data presented in this section are in no way intended to be indicative of the entire market for the time period covered.

## CONVERSION SUPPLY

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U <sup>+</sup> as U <sup>F</sup> ) |              |              | Remarks   |
|-------------------------------|-----------------------------------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                                                 | 1 to 2 Years | 2 to 3 Years |           |
| 1451                          | 75                                                                          |              |              |           |
| 1540                          | 900                                                                         |              |              |           |
| 1584                          | 200                                                                         | 200          | 200          |           |
| 1599                          | 150                                                                         | 300          |              |           |
| 1607                          | 850                                                                         | 900          | 1000         |           |
| 1609                          | 1000                                                                        |              |              |           |
| 1619                          |                                                                             | 175          |              |           |
| 1620                          | 125                                                                         |              |              |           |
| 1625                          |                                                                             | 300          | 500          | Long term |
| TOTALS                        | 3300                                                                        | 1875         | 1700         |           |

## CONVERSION DEMAND

| Nuexco<br>Reference<br>Number | Delivery Period*<br>(Thousands of Pounds U <sup>+</sup> as U <sup>F</sup> ) |              |              | Remarks   |
|-------------------------------|-----------------------------------------------------------------------------|--------------|--------------|-----------|
|                               | 0 to 1 Year                                                                 | 1 to 2 Years | 2 to 3 Years |           |
| 1594                          |                                                                             | 400          | 950          | Long term |
| 1608                          | 125                                                                         | 175          | 175          | Long term |
| 1614                          |                                                                             | 300          | 500          | Long term |
| 1622                          | 500                                                                         | 500          | 400          | Long term |
| 1626                          | 75                                                                          |              |              |           |
| TOTALS                        | 700                                                                         | 1375         | 2025         |           |

\*Measured from the date of this Report.

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URANIUM MARKET INDEX

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